THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[REGISTERED AS A NEWSPAPER.]

VOL. XXV. No. 618.] LONDON, MARCH 16, 1875. [27TH YEAR.] Price 6d.

RAMSAY'S NEWCASTLE CANNEL COAL. Analysis—10,000 cubic feet of gas per ton of coal; 26-candle gas; 13¼ cwt. coke per ton of coal.
The London Exhibition in 1851 was lighted with gas made from Ramsay's Cannel.
RAMSAY'S PATENT CONDENSED COKE.
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GAS-RETORTS, introduced 1828. FIRE-BRICK WORKS, established 1804. FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay. The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article. The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.
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These Paints are now used in 100 Country Gas-Works, and by all (but one) of the London Gas Companies, on Gasholders, Scrubbers, Purifiers, &c. They will cover tar effectually. Also used by the Admiralty, War Office, Railway Companies, Founders, &c.
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JOSEPH COWEN and CO.,
BLAYDON BURN, BLAYDON-ON-TYNE,
Were the only parties to whom a PRIZE MEDAL was awarded at the GREAT EXHIBITION of 1851, for "GAS-RETORTS and OTHER OBJECTS in FIRE-CLAY," and they were also awarded at the INTERNATIONAL EXHIBITION of 1862, the PRIZE MEDAL for "GAS-RETORTS, FIRE-BRICKS, &c., for EXCELLENCE of QUALITY."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
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JOHN RUSSELL AND CO.,
THE OLD TUBE-WORKS, WEDNESBURY;
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Established at the commencement of Gas Lighting.
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16, SOHO SQUARE,
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J. R. and Co. are the original manufacturers of Wrought-Iron Gas Tubes and Fittings, and Inventors of the LAP-WELDED TUBES for Locomotive and Marine Boilers.
J. R. and Co. make all kinds of Tubes and Fitting for Gas, Steam, and Water; Gun-Metal Cocks, Stocks, and Dies; Galvanized Tubes and High-Pressure Tubes, &c.
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FIRST-CLASS MATERIALS & WORKMANSHIP;
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Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
SUGAR, SALTPETRE, AND ALL KINDS OF PANS.
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RETORT-SETTING A SPÉCIALITÉ.
RETORTS SET, AND GUARANTEED TO BURN OFF A CERTAIN AMOUNT OF COAL, OR ELSE NO MONEY TAKEN FOR THE CONTRACT.
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Retort-Setters sent to all parts of Europe and America.
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Presented by Her Majesty's Government to the French Government;
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DRY GAS-METERS,
Warranted to Measure correctly, and not to vary.
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G. G. and Co. have just received the only Medal awarded for Gas-Meters at the Vienna International Exhibition.

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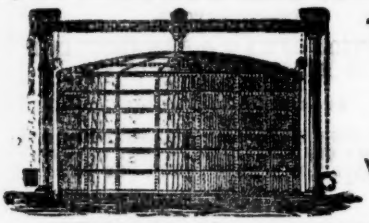

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RETORTS, ANNULAR AND PIPE CONDENSERS,

WROUGHT AND CAST IRON SCRUBBERS, PURIFIERS,

GASHOLDERS,

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AND PATENTEES OF THE IMPROVED COMBINED CONDENSING AND PURIFYING APPARATUS SO EMINENTLY ADAPTED FOR EXPORTATION.

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The superiority of the material supplied by this Company is generally recognized, and it is now in use in nearly all the London and most of the large Provincial Gas-Works.

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ESTABLISHED 1840,

GAS ENGINEERS, CONTRACTORS, IRON AND BRASS FOUNDERS,

WEST OF ENGLAND ENGINEERING WORKS, EXETER.

GASHOLDERS AND TANKS,

Retorts, Retort-Fittings, Condensers, Scrubbers, Purifiers, Station-Meters, Governors, Rack and Screw Valves. Gas and Water Mains always in Stock.

STEAM-ENGINES, EXHAUSTERS, SHAFTING AND GEARING, &c.

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Including Chandeliers, Pendants, Hall Lamps, Brackets, Star and Sun Lights of all designs.

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Combining most recent improvements in principle and manufacture; upwards of 200,000 already in work, giving highest satisfaction. (A guarantee of five years given with every Meter.)

PLUMBERS WORK, including Lift and Force Pumps; Cocks for Gas and Water and Steam; Brass Fittings.

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PATENT WELDED WROUGHT-IRON TUBES,

FOR GAS, STEAM, AND WATER;

GAS-FITTERS TOOLS, STEAM COCKS, AND ALL KINDS OF JOINTS.

HYDRAULIC TUBES, CORE BARS, TELEGRAPH POSTS, COILS, &c.

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EVERY DESCRIPTION OF TUBING, GAS, STEAM, HYDRAULIC TUBES AND FITTINGS,
EITHER BLACK, GALVANIZED, OR ENAMELLED HOT WATER TUBES AND FITTINGS,
CORE BARS, COILS, COCKS (IRON OR BRASS),
CHANDELIERS, &c., GAS-FITTERS' TOOLS, GAS TONGS, STOCKS, TAPS, DIES, &c., &c.,
HANDRAIL TUBINGS, IRON AND BRASS, PLAIN OR TWISTED,
TELEGRAPH TUBES OR POLES, &c., &c.

WILLEY AND FORD,

GAS ENGINEERS,

WORKS: COMMERCIAL ROAD, EXETER,

INVITE THE ATTENTION OF GAS COMPANIES AND OTHERS FOR THE SUPPLY OF

EVERY DESCRIPTION OF GAS APPARATUS.

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NEW GAS-WORKS erected complete. Plans and Estimates furnished. MAINS, METERS, SERVICES, LAMPS, &c., adapted for Towns of any size. Gas Companies advised on Improvements, Extensions, and Alterations of Works.

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RETORTS and RETORT-HOUSE FITTINGS, CONDENSERS, SCRUBBERS, ENGINES and EXHAUSTERS, PURIFIERS, STATION-METERS, GOVERNORS, VALVES, &c.

METER DEPARTMENT.

They beg special attention to the excellence and superiority of their WET and DRY METERS, several thousand being now in use by many of the largest Gas Companies in the West of England and South Wales. Warranted to measure correctly, and not to vary. Their acknowledged superiority has brought them into general use more rapidly than any Meters hitherto manufactured. A guarantee of Five years tendered with each Meter.

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An extensive variety of Choice Designs in CHANDELIERS, PENDANTS, BRACKETS, STAR and SUN LIGHTS, MEDIÆVAL FITTINGS for CHURCHES, &c.

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GAS ENGINEERING WORKS, COMMERCIAL ROAD, EXETER.

CAFFALL, THOMAS, & CO., LIMITED.

PATENT IMPROVED SEAL

FOR

GAS HYDRAULIC MAINS.

SAVES COAL, RETORTS, FUEL, LABOUR, TIME, SPACE, AND CAPITAL.

PREVENTS STOPPAGE OF ASCENSION-PIPES, DEPOSITION OF CARBON IN RETORTS, THICKENING OF TAR IN HYDRAULIC MAIN.

GIVES MORE GAS PER TON OF COAL, WITH HIGHER ILLUMINATING POWER, SATISFACTION, AND PROFIT TO SHAREHOLDERS AND MANAGERS.

IS STRONG, SIMPLE, EASILY FIXED AND WORKED, AND THOROUGHLY EFFICIENT AT ALL TIMES.

TESTIMONIAL.

Gas-Works, Guildford, Sept. 15, 1874.

GENTLEMEN,—The five retorts fitted with your Patent Moveable Seal for Dip-Pipes, on June 30, have been in constant use since that date, and have worked in a most satisfactory manner.

These Retorts are still quite clean and free from carbon, whilst others not so fitted, after being at work eight weeks, required scurfing, having a deposit of carbon 2 inches in thickness on the inside.

I also find a slight increase in the yield of gas per ton of coal carbonized, although your Patent Seals are fitted to but one-fifth of the Retorts now at work.

As your statements respecting your apparatus are fully confirmed by the results obtained in practical working, I should wish you at once to fix one to each of the ovens at these works, that I may obtain all possible advantage during the coming winter.

Yours truly,

Messrs. Caffall, Thomas, and Co., Limited, 28, Gracechurch Street, E.C. JOS. SHAW, Manager.

MODELS MAY BE SEEN, AND INFORMATION OBTAINED, AT THE OFFICES, 28, GRACECHURCH STREET.

Established

1795.

JOSEPH CLIFF & SON,

THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

MANUFACTURERS OF ALL DESCRIPTIONS OF

FIRE GOODS, and Salt-Glazed Drain-Pipes.

LONDON WHARF:

Wharf No. 4, inside Great Northern Goods Station, King's Cross, N.;

LIVERPOOL—1, Back Leeds Street,

Where is always kept a Stock of Retorts, Fire-Bricks, Terra Cotta Ware, and Drain-Pipes.

J. T. B. PORTER AND CO.,

ENGINEERS AND CONTRACTORS,

LINCOLN, AND 1, WESTMINSTER CHAMBERS, LONDON, S.W.,

Beg respectfully to remind Gas Companies and Corporations that they continue to manufacture and supply every description of Apparatus connected with the

MANUFACTURE OF GAS AND ITS DISTRIBUTION.

GASHOLDERS, PURIFIERS, SCRUBBERS, CONDENSERS, RETORTS, &c., &c.

PLANS, SPECIFICATIONS, AND ESTIMATES FOR WORKS OF ANY SIZE.

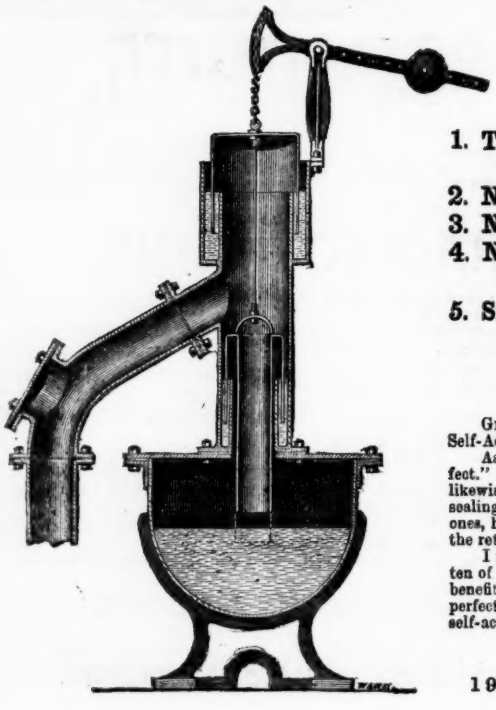
REFERENCES TO MORE THAN 500 WORKS ALREADY ERECTED.

PROSPECTUSES AND TESTIMONIALS ON APPLICATION.

SELF-ACTING REMOVABLE DIP-PIPE,

PATENTED BY

CHANDLER & STEVENSON.



ADVANTAGES.

1. There is no pressure on the Retorts.
2. No deposit of Carbon.
3. No scurfing is required.
4. Never a choked Ascension-Pipe.
5. Saves Fuel and Wear and Tear.
6. Gets 10 per cent. more Gas out of the Coal, and a higher Illuminating Power.
7. Is never out of order.
8. Requires no attention.
9. Is perfectly automatic in its action.

TESTIMONIAL.

Metropolitan District Asylum, Caterham, Surrey, Dec. 14, 1874.

MESSRS. CHANDLER AND STEVENSON.

GENTLEMEN,—I have much pleasure in bearing testimony to the complete working of your "Patent Self-Acting Dip-Pipes," which have now been in constant operation over three months.

As regards the action of the apparatus, I can describe it no better than by calling it "simply perfect." Immediately the retort is charged and the lid secured, the small holder rises, which lifts the Dip; likewise the instant the gas is permitted to escape at the mouthpiece the holder falls, thus perfectly sealing the Dip. I am fully convinced of the superiority of these Self-Acting Dips over Non Self-Acting ones, having experienced the fact that stokers do occasionally neglect to unseal the Dip after charging the retort, thereby causing a waste or loss.

I feel that it is quite unnecessary for me to say more on the subject, excepting that, having had ten of Messrs. Chandler's Dip-Pipes in use more than one year, and having experienced the great benefits derived thereby, inasmuch as the yield of gas from the coal is greatly increased, and the retorts perfectly free from carbon and other advantages, and seeing that the same Dip has been made perfectly self-acting by the second patent, I feel convinced that this is the right thing.—Yours obediently,

W. CRICKMAY, Resident Engineer.

For terms of use and cost, apply to Mr. G. W. STEVENSON,

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THE THAMES BANK IRON COMPANY,

(Successors to LYNCH WHITE,)

SUPPLY FROM STOCK

CAST-IRON RETORTS, SOCKET-PIPES for GAS or WATER PURPOSES, FLANGE-PIPES for STEAM, RAIN-WATER PIPES and GUTTERS, HOT-WATER PIPES and BOILERS, and all requisite Connexions for same; also LAMP-COLUMNS, LAMPS, WROUGHT FRAMES, WROUGHT-IRON TUBING, &c., &c.

All kinds of Gas-Works Apparatus and General Castings made to Pattern or Drawing.

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OXIDE OF IRON.—We are prepared to supply, on moderate terms, HYDRATED PEROXIDE OF IRON (BOG OCHRE), Same quality as supplied by us to several of the most extensive Gas Companies, and which has given entire satisfaction.

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BELFAST.

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GAS-WORKS, IPSWICH,
SOLE AGENT FOR
EDGE'S PATENT
FOR REMOVING THE
CARBONACEOUS INCRUSTATION FROM GAS-RETORTS.

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER;

Manufacturers of

IMPROVED CONSUMERS WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

AND

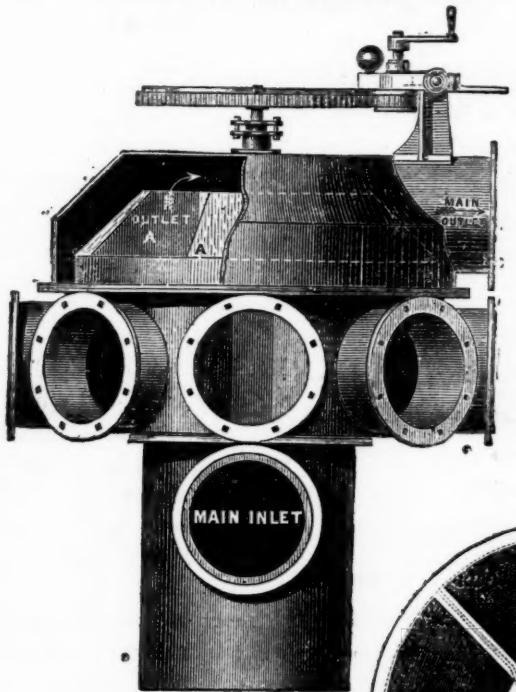
IMPROVED DRY GAS-METERS;

STATION-METERS OF ALL SIZES, with PLANED JOINTS;

GOVERNORS, PRESSURE AND EXHAUST REGISTERS, TEST HOLDERS.

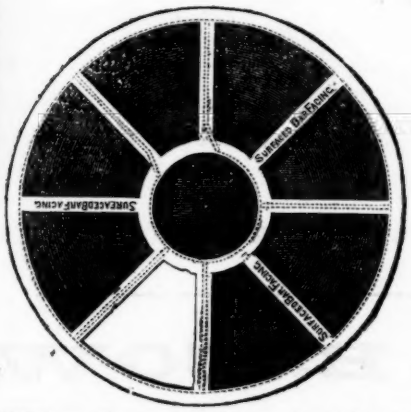
And all kinds of Experimental Gas Apparatus.

C. & W. WALKERS' PATENT CENTRE-VALVES.



Elevation of the Centre-Valve for four Purifiers. The safety cover is shown broken, to enable the Valve itself, which is inside, to be seen.

Plan of the Body, showing the Valve lying in it, with three of the facings, which were formerly exposed to settlements of dirt, carbon, naphthaline, &c., but which are now always covered by the surfaced bar-facings of the Valve. (See below.)



Plan of the Valve, or upper portion, showing the surfaced bar-facings referred to above.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A very considerable improvement and saving is effected in the cost of the connecting-pipes.

FOUR-WAY CENTRE-VALVES FORMING INLET, OUTLET, AND BYE-PASS.

MIDLAND IRON-WORKS, DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

W. & B. COWAN,

ESTABLISHED 1827,

KING HENRY'S WALK,

BALL'S POND ROAD,
LONDON, N.

BUCCLEUCH ST. WORKS,
EDINBURGH.

Remarks on some Points of Agreement and Difference in Meters that have been generally adopted for the Measurement of Gas :—

WET METER
(COMMON).

Variable measure, and affected by valvular (hood) action; **variation limited** to height of spout and range of float. Measures and valves (hoods) are constructed together, and form but parts of a simple wheel revolving on an axis; the variation of measurement arises from the variation of water-line.

Measures constructed of incorrodible metal.

Valves (hoods) formed by portions of the measures passing through the water in the meter.

Action of the float and valve sensitive and limited.

DRY METER
(EVERY MAKE).

Variable measure, and affected by valvular action. **Variation unlimited,** depending upon the condition of leather and valves. Measures and valves are separate and distinct parts of the Meter, and complicated by the mechanism necessary to transmit the motion of one part to the other.

Measures formed of a porous leather. Valves formed by surfaces of metal rubbing over each other. Action of Meter sensitive from rubbing surfaces of Valve. Allows gas to pass unregistered, but none of the others permit this.

WET METER
(COMPENSATING).

Dependent on a true as well as a fixed water-line. Varies more or less, and to the extent of range of float, if it is adjusted to water-line. Measures and valves as in the common Meter in construction and action, but it is complicated by external arrangements, to ensure as far as possible a constant water-line, on which the accuracy of measurement is dependent.

Valves (hoods) as in common Meter. Action of float and valve depends upon their position in the Meter.

WET METER
WARNER & COWAN'S
(SELF-REGULATING DRUM).

Unvarying measure, and unaffected by valvular (hood) action.

Measurement accurate through the whole range of float.

Measuring-wheel constructed with an inner wheel, by which the action of the Meter is neither impeded nor complicated, and which ensures **accurate measurement, with a varying water-line.**

Measures incorrodible metal. Valves (hoods) as in common Meter.

Range of float increased, and less liable to be affected by change of pressure or consumption.

THE RANGE ALLOWED BY SALES OF GAS ACT NECESSARY IN THESE METERS.

NO RANGE NECESSARY.

W. & B. COWAN,

ESTABLISHED 1827,

KING HENRY'S WALK,

BALL'S POND ROAD,
LONDON, N.

BUCCLEUCH ST. WORKS,
EDINBURGH.

TANGYE BROTHERS AND HOLMAN,

10, LAURENCE POUNTNEY LANE, LONDON, E.C.

SOLE MAKERS OF

MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH

HOLMAN'S PATENT ECCENTRIC FASTENINGS,

ANTI-FRICTION CATCHES, AND NEW SELF-SUSTAINING CROSS-BARS,

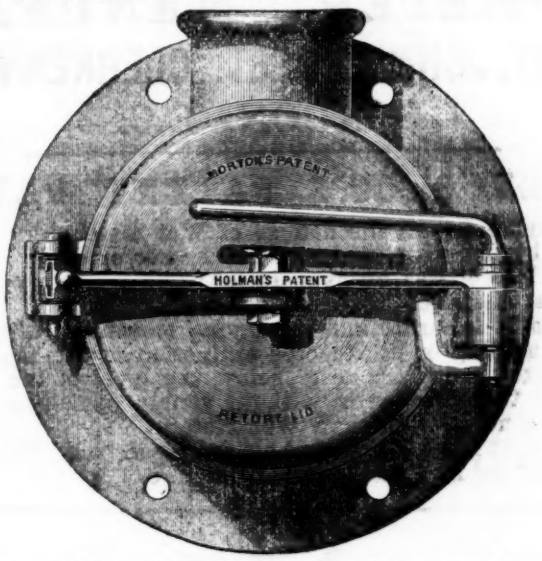
NEARLY 15,000 IN USE.

NO LUTING.

NO DUPLICATE LIDS REQUIRED.

INSTANTANEOUS SEALING EFFECTED.

VERY DURABLE.



HOLMAN'S NEW SELF-SUSTAINING CROSS-BAR ENSURES FREEDOM OF JOINT, AND MAINTAINS PARALLEL POSITION OF THE LIDS.

By the employment of MORTON'S PATENT SELF-SEALING RETORT-LIDS, with HOLMAN'S PATENT ECCENTRIC FASTENINGS, the old-fashioned, cumbersome, and expensive method of sealing Retorts, by luting the lids with lime and other materials, is entirely dispensed with.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested (rigid cast iron is now successfully employed), nearly 15,000 being in use at various Gas-Works in London and the Provinces, among which may be mentioned:—

The Gaslight Co., Beckton (where, by the end of 1875, nearly 4000 will be in use).
" Gaslight Co., Bow Common.
" Gaslight Co., Silvertown.
" Gaslight Co., Lupus Street.
" London Gaslight Co.
" Independent do.
" Phœnix do.
" South Metropolitan Gaslight Co.
" Commercial do.
" Imperial do.
" West Ham Gas Co.
" Gas-Works, Royal Arsenal, Woolwich.
" do. Barnet.
" do Lower Sydenham.
" do. Brentford.
" Consumers Gas Co., Woolwich.

The Alliance and Dublin Gas-Works.
" Edinburgh do.
" Manchester Corporation do.
" Salford do. do.
" Rochdale do. do.
" Liverpool Gas-Works.
" Birmingham do.
" Birkenhead do.
" Nottingham do.
" Newcastle-on-Tyne Gas-Works.
" Lurgan do.
" Carmarthen Gas-Works.
" Merthyr Tydfil do.
" Windsor do.
" Leeds do.
" St. Albans do.
" Over Darwen do.
" Rotherham do.
" Aylesbury do.

The Bournemouth Gas-Works.
" Ystrad do.
" Cardiff do.
" Rochester do.
" Keighley do.
" Aberdare do.
" Ballymena do.
" Richmond do.
" Stalybridge do.
" Longton do.
" Exeter do.
" Ross do.
" Falmouth do.
" Barrow-in-Furness do.
" Belfast do.
" Wakefield do.
And other Provincial and Foreign Gas-Works.

IMPORTANT TESTIMONIAL.

The Gaslight and Coke Company (Commonly called the Chartered Gas Company), Beckton, North Woolwich, July 2, 1874.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—In answer to your inquiry respecting the Self-Sealing Lids, I beg to say that they continue to work well, and I have every reason to be satisfied with them.

I should be very sorry to return to the old system of Luting, and our stokers here freely acknowledge the benefit to them of the new system.

I am, yours truly,
(Signed) G. C. TREWBY.

P.S.—We shall have very shortly about 3000 of your Lids in use.

London 1851. New York, 1853 Paris, 1855. London, 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS,

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

COTTAGE LANE, CITY ROAD, LONDON, E.C.

Established 1816.

MANUFACTURERS OF PATENT

WET & DRY GAS-METERS,

STATION-METERS WITH PLANED JOINTS,

GOVERNORS, PRESSURE REGISTERS, GAUGES,

AND EXPERIMENTAL APPARATUS,

STREET-LAMP METERS,

AND REGULATORS FOR AVERAGE METER INDICATION.

METERS FOR MEASURING WATER.

CONTENTS.

Circular to Gas Companies:— PAGE
Coming Interview of the Gas Companies with the Home Secretary. . . . 357
Mystification in the Common Council 357
The Association of Municipal Corporations and the Home Secretary . . . 357
The New Public Health Act and Gas Companies 357
Extension of Public Lamps in the Metropolitan District 358
The Corporation of Bath and the Gas Company. 358
Negotiations at Southampton 358
Gas Affairs at Shrewsbury 358
The Cork Consumers Company 358
Water and Sanitary Notes:—
Withdrawal of the Wakefield Water Bill 358
A Ratepayers Meeting at Truro. 358
The Public Health Act and the Supply of Water 358
Leading Articles:—
The Use of Gas in Lighthouses 358
A Treatise on the Science and Practice of the Manufacture and Distribution of Coal Gas 359
Correspondence:—
Form of Gas Companies Accounts 361
Testing the Illuminating Power of Coal Gas 361
Plymouth Gas Company 361
Brick Ovens 361
Parliamentary Intelligence:—
Progress of Bills in House of Lords 361
Progress of Bills in House of Commons 361
House of Commons Committee—Carmarthen Gas Bill 362
Public Health Bill—Powers of Local Authorities in Relation to the Supply of Water and Gas 367
Legal Intelligence:—
Court of Chancery—
Re Coal Economizing Gas Company. 368
Attorney-General *v.* The Tunstall Local Board of Health 368
Lancaster Spring Assizes—Hunter *v.* Ulverston Local Board 368
Westminster Police Court—Summons for Gas-Rent alleged to have been Paid . 368
Miscellaneous News:—
Chippenham Water Supply. 359
Death of the Manager of the Stratford-on-Avon Gas-Works 360
Testimonial to Mr. W. Moss 360
Metropolis Gas Supply 369
Hornsey Gas Company 369
Accounts of the Metropolitan Water Companies for the Year 1873-4. . . . 370
Metropolis Water Supply 371
Meeting of the Cork Gas Consumers Company 371
Meeting of the Harrow District Gas Company 372
Meeting of the Newcastle and Gateshead Gas Company 373
Glasgow (Corporation) Water-Works 373
Specific Heat of Gases 373
Borough of Bolton Gas-Works 373
Hereford (Corporation) Gas Supply 373
Glossop Gas Supply 374
On the Construction of Gasholders. By John A. Coombs 374
New Lights 377
Gaiffe's Apparatus for Lighting Gas 377
Iron and Coal Trades of Sheffield, South Yorkshire, and North Derbyshire. . 377
Iron and Coal Trades of South Staffordshire and East Worcestershire . . . 377
Iron and Coal Trades of Lancashire 378
Coal and General Trade of the North 378
Trade Notes from Scotland 378
Testimonial to Mr. A. T. Walker 378
Alleged Theft of Gas in Glasgow 378
Sale of Gas Shares at Bury St. Edmund's 378
Glasgow Water Supply 378
London Street-Lamps 378
Philadelphia Gas-Works 378
Gas-Works in Japan. 379
Foreign Shipments of Pipes, Gas Coal, &c.. 379
Municipal Corporations (Borough Funds) Act 379
Register of New Patents:—
Connell, W.—Water Supply Valves 379
Bentley, J.—Pumps 379
Kunstadter, J. J.—Obtaining Motive Power 379
Colls, F. W.—Sewer and Drain Traps 379
Wells, J.—Main Cocks 379
Walker, W.—Steam-Pumps 379
Bean, E. E.—Gas Lighting Apparatus 379
Wilson and Steele—Cooling and Heating Liquids, &c. 379
Cooper, H. E. Carburetting Air or Gas 379
Hallsworth and Bailes—Clarifying Impure Water 379
Dixon, F.—Disinfecting Sewer Gases 379
Mackenzie, T.—Steam Pumps and Blowers 379
Whitton, C.—Steam Pipe Valves 380
Warrer and Wates—Charging and discharging Retorts 380
Schmersahl, A. E.—Purifying Sewage 380
Lyttle, W. A.—Treating Sewage 380
Scott, H. Y. D.—Treating Sewage 380
Spence, W.—Treating Sewage. 380
Jones, H. L.—Disinfecting Water-Closets, &c. 380
Warburton, S.—Gassing Yarns 380
Applications for Letters Patent 380
Grants of Provisional Protection 380
Notices to Proceed 380
Invention protected for Six Months 381
Patents which have passed the Great Seal 381
Patents which have become void 381

TO CORRESPONDENTS.

We repeat the announcement made last week, that communications received later than Saturday, cannot be inserted in the forthcoming No. of the JOURNAL.

THE JOURNAL OF GAS LIGHTING, WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MARCH 16, 1875.

Circular to Gas Companies.

THE Corporation of London and the Metropolitan Board of Works having had the opportunity of interviewing the Home Secretary on the gas question, it was quite natural that the companies should also seek for an interview, in order that Mr. Cross might be informed of both sides of the question. Accordingly, the governor of the Imperial Company communicated with the Home Secretary, who, in reply, expressed his willingness to receive a deputation from the companies. The interview will take place to-day, and, if it be possible, our readers will be duly informed of the proceedings. The letter which Mr. Richards addressed to the Home Secretary—a few copies of which were printed for circulation among the companies—will be found in another column. Assuming that the account of the interview with the authorities, as related by Mr. Newton, is correct—and we have no doubt that it is—we must confess that it never occurred to us to be "alarmed" at the reply Mr. Secretary Cross is reported to have made. He committed himself to nothing in opposition to the interests of the companies, and merely promised to help the Metropolitan Board in the matter of the Regulation Bill, "*if possible.*" We felt satisfied that, when Mr. Cross gave the Bill his "best attention," he would find that to support it would be impossible, and there we left the matter. It is well, however, that both sides of the case should be represented to such an important official, and, therefore, we are glad that a deputation from the companies are to have an interview with the Home Secretary.

Whatever reply Mr. Cross may make—and it will naturally be a vague and cautious one—will not, we presume, have any effect in preventing a parliamentary contest. Nothing but the withdrawal of the obnoxious Bill could do so; and although we do not regard this as an altogether improbable event, we must counsel the metropolitan companies to prepare themselves for the severest light they have yet had. The interests at stake to-day are of infinitely greater importance than those involved in the dispute of 1860. If this Bill should pass, the value of gas property in the metropolis will be depreciated to the extent of several millions; in which depreciation Mr. Cross will not fail to see an act of downright confiscation. He will see plainly, too, that this act of confiscation is contemplated with a view to further spoliation. The Metropolitan Board desire not only to kill, but to take possession. Mr. Cross will easily see through this attempt to depreciate the value of property in order to acquire it at a cheap rate, and will recognize, in the proceedings of the Metropolitan Board, a certain resemblance to the tactics of the little chimney-sweep, who stuck his sooty finger into a jam tart, and then asked the price of it.

It is really amusing to see the mystification of the Common Council of the City of London respecting the proceedings of their Gas Committee. The Regulations Bill has been read once in the House of Commons, has been printed and largely circulated, we ourselves having given a tolerably full account of its provisions. But the chairman of the Corporation Gas Committee does not seem to understand that the Bill has been put into shape. Whether the Metropolitan Board have condescended to furnish the City Committee with copies of the numerous revises of the Bill they have had printed, of course we do not know; but it does look odd that the Common Council should be kept so much in the dark as to proceedings in which they are considered to take a great interest.

The deputation from the Association of Municipal Corporations, who last Thursday waited upon Mr. Cross, to urge the advisability of repealing or modifying the Borough Funds Act, could not have derived much satisfaction from the interview. The Home Secretary is evidently rather disinclined to remove any of the existing checks on the squandering of money by ambitious town councillors and reckless members of Local Boards. He considers, it is true, the provision which requires the consent of a majority of ratepayers to any extraordinary expenditure "a clumsy arrangement;" but, granting that ratepayers should have control over the expenditure of money which must be drawn from their pockets, can the present arrangement be improved upon? Mr. Cross declined to commit himself to any expression of opinion on the proviso in the Act which prohibits the promotion of any Bill in Parliament for the establishment by local authorities of gas or water works to compete with existing statutory undertakings. It was, he said, a question of considerable importance worthy of investigation. The question was, we rather think, very fully investigated in the course of the two years during which the Borough Funds Bill was under discussion, and we do not believe the mature decision of the last will be disturbed by the present Parliament.

The Bill to consolidate and amend the Acts relating to Public Health, brought in by the Government, contains one or two provisions respecting gas supply, against which we have no great objection, but to which we may as well call the attention of gas companies. In the first place, it is proposed to give to urban authorities, where no authorized gas-works exist in the district, the power to set up a gas undertaking. We see no objection to this, for, wherever gas-works are likely to pay, private enterprise is certain to start them. And further, if any urban authority desire to supply gas, they will have to obtain a Provisional Order authorizing the undertaking, according to the provisions of the Gas and Water Works Facilities Act, 1870. There is here sufficient protection for the ratepayers, who will, of course, have the opportunity of opposing the Order, if they should consider it inimical to their interests. The next proposal is not quite so harmless. In very numerous instances the limits of gas compa-

nies do not coincide with the boundaries of the urban authorities, and the Bill provides that, in such cases, the authorities may obtain a Provisional Order, conferring power to supply gas within such part of their district as lies beyond the company's limits. The operation of this section will require to be watched both by gas companies and ratepayers.

The only other section we need notice here is that which will give a general power to gas companies to sell, and urban authorities to purchase, gas undertakings by agreement. We see no objection to giving the greatest facilities for such transactions, provided care be taken to prevent harassing preliminaries. If urban or other authorities want gas undertakings, they can always get them by paying a fair price; and although we must admit that we see with some regret every transfer of a strictly industrial undertaking to a local authority, whose legitimate business we regard as quite other than dealing in commercial products, we do not now remonstrate. It is a fashion of the day, and the absorption of undertakings will probably go on for some years.

A return just issued by the Metropolitan Board of Works will, perhaps, give as good an idea of the vast extension of gas enterprise in the metropolis as can be obtained. It shows the total amount of new works executed by the vestries and District Boards of the metropolis from Jan. 1, 1856, to March 25, 1874. We need mention here only the number of street-lamps added; they amount to no fewer than 17,480. The growing districts are clearly indicated in the return. Thus, in the parish of Kensington, 2275 lamps have been added in the course of the 18 years; in St. Pancras, 1867; in Lambeth, 1311; in Islington, 1246; and in Hackney, 1459. It is, however, curious to see that in some of the central districts not a single additional lamp has been placed. In the Strand, in St. Martin's-in-the-Fields, and even in St. Luke's, the number of public lamps is now exactly the same as it was 18 years ago. It must be admitted that in the Strand district, and also in St. Luke's, there are courts and alleys which might be improved by a better illumination.

The Corporation of Bath have withdrawn from their opposition to the Bill of the gas company, who have assented to most of the proposals of the Corporation. It has been agreed that *one-third* of the new capital shall be raised by 5 per cent. debenture bonds; but possibly Lord Redesdale may have something to say on this matter. The maximum charge for public lights is to remain as before—£3 per lamp—and the minimum illuminating power of the gas is, for the future, to be 14 candles. The Corporation of Bath must be regarded as antagonistic to the gas company, but they have agreed to one clause, which we may commend to the notice of the Corporation of London and Metropolitan Board. It provides that the company are not to be liable to a penalty unless the gas is below the standard *for seven consecutive days.*

We inferred too much from some remarks made by the Mayor of Southampton at a meeting of the Town Council, referred to in our last. It seems that terms of purchase and sale have not been agreed upon by the Corporation and the gas company; but we believe we are justified in stating that negotiations are still pending.

Among the arguments commonly used, as at Southampton, by timid ratepayers, who are frightened at the prospect of the contraction of heavy liabilities for the purchase of gas undertakings, there is one which may be turned to good account by the gas companies. It is the possibility of the discovery—it may be to-morrow—of some better and cheaper illuminating agent than gas, in which event the money would be all wasted. Surely, there is here an argument for allowing the companies to make hay while the sun shines, or, rather, profits while the gas shines. The little knowledge of science we possess does not enable us to see, or even to guess, what the new illuminating agent may be; but, granting the possibility of the discovery, which we cannot deny, and the consequent extinction of gas, it follows that many millions of money will be rendered unproductive, which is now restricted to a minimum of profit.

Anonymous attacks on gas companies generally precede efforts by Town Councils to acquire gas undertakings. This game has been commenced in Shrewsbury, and is most unjustifiable. In no town in the kingdom are the conditions of supply, as regards illuminating power and purity, better fulfilled than in Shrewsbury, and the profit made by the gas company is most moderate. We see that an alderman complains that he is obliged to supplement the gas in his study by the addition of two candles. The worthy gentleman is, no doubt, getting on in years, and most likely has suspended a bad gaselier far above his head, which organ, as he sits at his writing-table, obstructs much of the light which streams from the gas.

The Cork Gas Consumers Company have been able to declare a dividend for the past half year at the rate of 5 per cent. per annum, and to carry £747 to the reserve-fund. This result is, of course, secured by the advanced price granted by the Board of Trade, which will only continue during the present year.

Water and Sanitary Notes.

Frightened at the prospect of another enormously expensive, and, if unsuccessful, ruinous parliamentary contest, the Wakefield Water Company have withdrawn their Bill. Thus the inhabitants of Wakefield will continue to be supplied from the source so graphically described by Dr. Frankland in the lecture we published last week. It is true the company take unusual pains in the filtration and purification of the water, and the fluid delivered is not the inky liquid which, as shown at the lecture, will produce legible writing. Still, it is admitted by all parties, that the water taken from the Calder is not, even after most careful treatment, well fitted for domestic consumption. We must sympathze with the directors, and hope they may soon be able to hit upon a scheme which they may carry without opposition.

A ratepayers meeting, convened by the Town Council of Truro, to obtain consent for opposition to the Truro Water-Works Bill, decided, by a majority of more than two to one, "that further "opposition to the Bill, promoted by the private company, is "needless, and that the ratepayers refuse to sanction the waste of "the ratepayers money in opposing the said Bill." The Town Council have sunk a well which yields no water, and they are charged with driving a level from the well, with the deliberate intention of tapping a river, the water of which is contaminated with arsenical pyrites. The water company will now be allowed to proceed in peace; but it is alleged against them that they have no intention to construct the works, if they get the power to do so. A ratepayer, at the meeting, asked if it would not be better for the Town Council to buy a good scheme than to throw money down "that well." Perhaps, after all, the best solution of the difficulty would be found in the purchase, by the Corporation, of the company's rights, if they should be acquired.

It will be seen by the provisions of the Public Health Bill, which we print in another column, that the Government do not propose to disturb the existing relations between water companies and local authorities. The latter will still have the power to construct works where no company are in possession, and will continue to have very proper authority to compel an adequate supply where a company does exist. The provisions are, in fact, those of the Public Health Act, 1848, and the Local Government Act (1858) Amendment Act, 1861, consolidated, with necessary changes in the designation of the authority. The Act will confer the same power of purchase and sale as is provided for in the case of gas-works previously referred to. The Bill, we may say, is simply to consolidate twenty Acts relating to Public Health already in force; and, although it is called an amending Bill, we have discovered but few and unimportant alterations in the existing laws. The size of the Bill, however, which consists of 333 clauses, occupying 128 pages, with various schedules, taking up about 30 pages more, makes a complete study of it an onerous task. We see no objection to this consolidation, which is timely, and will prove useful; but we are at present only on the threshold of knowledge as to the most important sanitary matters, and the Legislature will, year by year, find increased occupation in dealing with and amending sanitary measures.

THE USE OF GAS IN LIGHTHOUSES.

Some further papers have been issued by the Government, on the use of gas as the illuminating agent in lighthouses. As our readers know, this application of gas is mainly due to the inventive genius and persevering exertions of Mr. J. R. Wigham, whose brilliant light on the clock-tower of the Houses of Parliament nightly appeals to our legislators—though rather hopelessly, unless "whips" are used—to attend to the business of the nation. We are glad to be able to add that Mr. Wigham is strongly supported by a no less authority than Dr. Tyndall, who writes as follows in one report among these papers:—

During my recent visit I made experiments on the flashing of the fixed light at Howth Baily. The results assure me that with gas as a source of illumination an amount of variableness, and consequent distinctiveness, is attainable which is not attainable with any kind of oil. It would, I think, be easy to give to every lighthouse supplied by gas so marked a character that a mariner on nearing the light should know, with infallible certainty, its name. As stated in a former report, I look, in great part, to the "flexibility" with which gas lends itself to the purposes of a signal light for its future usefulness. It may be beaten, in point of cheapness, by the mineral oils now coming into use (that is still to be proved); but in point of handiness, distinctiveness, and power of variability to meet the changes of the weather, it will maintain its superiority over all oils. I therefore respectfully submit to the Board of Trade, that, while withholding all countenance from extravagant or fanciful experiments, it will be wise to encourage, as hitherto, the gradual, economical, and consequent healthy expansion of the system of gas illumination in Ireland.

The terms "flashing" and "flexibility" here used require a short explanation. Every one knows what a "revolving" light is. The alternations of darkness and light when oil-lamps are employed, are produced by mechanical and optical arrangements, while the consumption of the oil proceeds at the same rate. But when gas is used the "flashing" is effected by turning the gas off and on, so that a large saving of consumption is made. The

"flexibility" is due to the invention of Mr. Wigham, who brings into use from 28 to 148 jets, according as the weather is clear or foggy. It is certain that no arrangement of oil wicks can produce a like effect, and therefore all must agree with Dr. Tyndall, that in the "power of variability to meet changes of the "weather, gas will maintain its superiority over all oils."

We do not propose to go at any length into the contents of these papers, but there are one or two points of great interest which must be referred to. Among the reports is one by Mr. Valentin on the photometric results obtained with the Wigham burner at the Haisborough Lighthouse. These are extremely curious, and, although we feel bound to say that we do not regard photometric experiments on this scale as calculated to give other than approximate results, the known skill and experience of the operator in this case, induce us to attach much weight to the observations. We append the table :—

Table showing Photometrical Results obtained with the Wigham Burner.

Power of Burner.	Illuminating Power in Sperm Candles, consuming 120 Grains per Hour. Mean of Ten Observations.	Hourly Consumption of Gas in Cubic Feet.	Illuminating Power produced by 1 Cubic Foot of Gas.
1st power, or 28-jet burner	429·6 candles	51·4 cubic feet	8·36 candles.
2nd „ 48 „	832·0 „	93·2 „	8·92 „
3rd „ 68 „	1253·18 „	146·3 „	8·57 „
4th „ 88 „	2408·0 „	244·0 „	9·87 „
5th „ 108 „	2923·4 „	308·0 „	9·43 „
6th „ 148 „	3136·0 „	420·0 „	7·46 „

The above table would seem to show that gas cannot be economically burned beyond a certain rate. We will put the table in another shape, and start with the 28-jet burner, consuming 51.4 cubic feet per hour, and giving the light of 429·6 candles. Then—

Increase in Number of Jets.	Total Number.	Increase in Consumption. Cubic Feet per Hour.	Increase in Illuminating Power. Candles.
20 ..	48 ..	41·8 ..	403
20 ..	68 ..	63·1 ..	421
20 ..	88 ..	97·7 ..	1155
20 ..	108 ..	64·0 ..	515
40 ..	148 ..	112·0 ..	213

Thus we see that, in one case, an increased consumption of 97·7 feet per hour gave an additional illumination of 1155 candles; while, in the last case, the increased consumption of 112 feet only added 213 candles to the illuminating power. This looks very odd, and we must confess that, at present, we are not clear as to the cause of the result. Dr. Valentin remarks upon it as follows, and his explanation is probably correct; and, if so, the defective arrangement may be remedied at once :—

It follows from these figures—1, that when gas is burned in large quantities by this powerful burner, it produces *proportionally* more light than can be obtained by burning it in an ordinary fishtail, bat's-wing, or Argand burner; for power 4, *ex. gr.*, gave nearly 10-candle light for every cubic foot of gas consumed, equal to an illuminating power of close upon 40 candles, instead of 27·24 for 4 cubic feet of gas. In fact, the least perfect combustion, owing, in all probability, to an insufficient supply of atmospheric air, as exemplified by power 6—viz., 7·46-candle power for every cubic foot of gas consumed—gives still higher results than that produced by the test fishtail burner I employed. It is clear, then, that there is a considerable advantage in burning gas from powerful burners. 2. That a better photogenic effect is produced by powers 2 and 3 than by power 1, likewise by powers 4 and 5 than by power 6. This is owing, in my opinion, to the greater indraught of air, dependent upon the terminal mica chimneys. Powers Nos. 2 and 4 are, in fact, more economical than powers 3, 5, or 6.

We have already quoted Dr. Tyndall's opinion that gas is more economical than oil, but we may here add Dr. Valentin's estimate of the respective costs of the lights at Haisborough :—

	Oil Light.*	Gaslight. Power I.
Comparative cost of the two lights	£151 5s. 2d.	£186 9s. 4d.
Comparative illuminating power	328 candles	429 candles.
Cost of lights of equal intensity	£151 5s. 2d.	£142 12s.
Proportional cost	100	94·3

Or a saving of 5·7 per cent. by using gas.

With lamps of higher power the advantage is much greater in favour of gas. Thus, with the second power (48 jets), as compared with the new 6-wick Trinity lamp, the saving by the use of gas is more than 43 per cent., and this with rich gas, made on a small, and necessarily expensive, scale.

Dr. Tyndall expresses a qualified opinion that Mr. Wigham's light is superior to the electric, and is anxious to have comparative experiments made to determine the relative cost, penetrative power, and general handiness of the two lights. The "Elder "Brethren" will probably consent to his proposal. There is no question here of companies and profits; but believing, as we do, that "there is nothing like gas," we hail with satisfaction every extension of its use.

CHIPPENHAM WATER SUPPLY.—The Local Government Board have authorized a loan by the local board of £8000 for providing a water supply for this town, and the Public Works Loan Commissioners have expressed their readiness to advance the amount, at the rate of 3½ per cent. interest; the principal and interests to be repaid by equal instalments in 30 years. Plans and specifications for making a reservoir and laying down the necessary pipes for distributing water through the town have been prepared by Messrs. Easton and Andrews, and are now before a committee of the local board for consideration, with a view to obtain tenders for the execution of the works.

* Four-wick Trinity lamp, with colza oil.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

LV.

GASHOLDERS.

The capacity of a gasholder is ascertained by multiplying the square of its diameter by ·7854, the product being again multiplied by the range through which it works. Thus, if we suppose the holder to be 50 feet in diameter, and 16 feet deep at the sides, and allow 12 inches for the seal and the space left at the top, to prevent it "touching" or "grounding" when in operation, it would leave a clear working range of 15 feet. Then, the square of 50 being 2500, multiplied by ·7854, is equal to 1963·5, and this again multiplied by the range, 15, gives 29,442 cubic feet as the working capacity of the holder.

Another and simpler, although not so accurate a method of arriving at the same result, is to subtract one-fifth part of the square of the diameter, and multiply by the range as before. Hence 2500, the square of the diameter, less 500 its fifth part, equals 2000, which multiplied by the range gives 30,000 cubic feet as the contents. For general practical purposes, the last method is the best, being more readily retained in the memory, and being simpler in execution.

The circumference of a cylindrical vessel, such as a gasholder, is ascertained by multiplying the diameter by 3·1416; hence, the diameter being 50 × 3·1416 = 157·08, say 157, the circumference required. Another and simpler way, but less accurate, is to multiply the diameter by 3, and adding to the product the seventh part of the diameter. Thus, 50 × 3 = 150, add 7·12, gives 157·12 as the circumference. The difference in the decimals shows the amount of inaccuracy of the latter method.

The area of the top, the circumference, the depth, the thickness of sheets of which a gasholder is formed, and the internal trussing being known, it then becomes a matter of simple calculation to ascertain its weight. For this object, and for making other estimates in connexion with the apparatus of a gas-work, the following tables of the weight of iron—as sheet, T, angle, flat, round, and square bars—are given. The first two relate to plates or sheets, their thickness being determined by the Birmingham wire gauge, which is usually adopted for sheet iron, copper, and brass :—

Table of the Thickness of Sheets, with the Weight per Superficial Foot, and their Numbers corresponding with the Birmingham Wire Gauge.

Thickness in Parts of Inch.	Weight per Square Foot in Pounds and Parts.	Thickness corresponding with Number on B. W. G.	Thickness in Parts of Inch.	Weight per Square Foot in Pounds and Parts.	Thickness corresponding with Number on B. W. G.
1/32	1·25	22	7/16	17·5	—
1/16	2·5	16	1/2	20·0	—
1/8	5·0	11	9/16	22·5	—
3/16	7·5	7	5/8	30·0	—
1/4	10·0	4	7/8	35·0	—
5/16	12·5	1	Inch	40·0	—
3/8	15·0	—			

The foregoing table may also be applied for ascertaining the weight of cast iron, either for the tanks of gasholders, boxes of purifiers, scrubbers, cases of station-meters, pipes, &c., as the area and thickness being known, the rest is readily calculated, due allowance being made for the difference between the weight of wrought and cast iron, the former being about 6 per cent. heavier than the latter. A more comprehensive table for all the various sheets used in the construction of gasholders and other apparatus, is the following, which gives the weight of a superficial foot of sheet iron in pounds or fractions, with its corresponding number of the Birmingham wire gauge, and its thickness in fractions of an inch :—

Weight of a Superficial Foot of Sheet Iron in Pounds or Fractions, with Corresponding Number of Birmingham Wire Gauge.

No. of Birmingham Wire Gauge.	Thickness in Parts of Inch.	Weight per Square Foot, lbs.	No. of Birmingham Wire Gauge.	Thickness in Parts of Inch.	Weight per Square Foot, lbs.
1	·312	12·5	13	·094	3·75
2	·290	12 0	14	·080	3·13
3	·273	11·0	15	·071	2·82
4	·250	10·0	16	·064	2·50
5	·230	8·74	17	·056	2·18
6	·202	8·12	18	·048	1·86
7	·187	7·50	19	·044	1·70
8	·168	6·86	20	·040	1·54
9	·152	6·24	21	·036	1·41
10	·134	5·62	22	·032	1·25
11	·122	5·00	23	·028	1·12
12	·108	4·38	24	·025	1·00

We have consulted the best English authorities in compiling this table. American writers differ slightly from it, by making No. 1 gauge of the weight of 12·1 lbs. to the foot, and No. 23 gauge 1 lb., all the intermediate kinds varying slightly in proportion.

*Table of the Weight of a Lineal Foot of Angle Iron of Varied Sizes and Thickness in Pounds.**

Breadth in Inches and Parts.	Thickness at Throat in Inches and Parts.	Thickness in Middle of Web in Inches and Parts.	Weight of 1 Foot. lbs. oz.
1¼ × 1¼	1/8	3/16	2 0
1½ × 1½	1/8	3/16	3 1
2 × 2	1/4	1/4	3 0
2¼ × 2¼	1/4	5/16	5 2
2½ × 2½	1/4	5/16	5 10
2½ × 2½	5/16	5/16	5 8
2½ × 2½	5/16	3/8	6 0
2¾ × 2¾	5/16	3/8	6 8
2¾ × 2¾	3/8	3/8	7 0
2¾ × 2¾	1/2	3/8	9 0
3 × 3	3/8	7/16	6 0
3 × 3	1/2	1/2	8 8

* Hegg's "Merchants and Iron Trades Guide."

Breadth in Inches and Parts.	Thickness at Throat in Inches and Parts.	Thickness in Middle of Web in Inches and Parts.	Weight of 1 Foot. lbs.	oz.
3½ × 3½	¼	7/16	8	0
3½ × 3½	5/16	⅜	11	12
3½ × 3½	⅜	⅜	15	0
3½ × 3½	1	½	14	0
4 × 2½	¼	⅜	7	10
4 × 3	⅜	7/16	9	0
4½ × 3	⅜	½	10	0
5 × 3	1	½	11	0
6 × 3	¼	7/16	13	0
6 × 3½	1	½	13	12

Table of the Weight of a Lineal Foot of T-Iron.

Breadth in Inches and Parts.	Thickness in Inches and Parts.	Weight in Pounds and Ounces per Foot run. lbs.	oz.	Breadth in Inches and Parts.	Thickness in Inches and Parts.	Weight in Pounds and Ounces per Foot run. lbs.	oz.
1½ × 1½	5/16	1	11	3½ × 3½	⅝	15	0
1¾ × 1¾	⅜	2	1	3¾ × 3¾	⅝	14	6
2 × 2	⅜	3	3	4 × 2½	⅝	8	0
2½ × 2½	¼	5	6	4 × 3	7/16	9	2
2½ × 2½	5/16	5	10	4½ × 3	½	10	5
2¾ × 2¾	⅜	6	14	5 × 3	½	11	8
3 × 3	⅜	6	8	6 × 3	7/16	13	6
3¼ × 3¼	7/16	8	4				

Table of the Weight of a Lineal Foot of Round and Square Bars in Pounds.

Diameter or Side, in Inches or Parts.	Round.	Square.	Diameter or Side, in Inches or Parts.	Round.	Square.
½	·653	0·830	1⅞	9·18	11·68
⅝	1·02	1·30	2	10·44	13·28
¾	1·47	1·87	2⅛	11·80	15·00
⅞	2·00	2·55	2¼	13·23	16·81
1	2·61	3·32	2⅜	14·73	18·74
1⅛	3·31	4·21	2½	16·32	20·80
1¼	4·08	5·20	2⅝	18·00	22·89
1⅜	4·94	6·28	2¾	19·76	25·12
1½	5·88	7·48	2⅞	21·59	27·46
1⅝	6·90	8·78	3	23·52	29·92
1¾	8·00	10·20			

Table of a Lineal Foot of Flat Bar Iron in Pounds.

Breadth in Inches and Fractions.	Thickness in Parts of Inch.								
	⅛	3/16	¼	⅜	½	⅝	¾	⅞	1 Inch.
½	·21	·31	·42	·63	..	..	..	..	..
¾	·31	·47	·63	·94	1·26	1·57	..	..	..
1	·42	·63	·84	1·26	1·68	2·10	2·52	2·94	..
1¼	·52	·78	1·05	1·57	2·10	2·62	3·15	3·67	4·20
1½	·57	·86	1·18	1·73	2·31	2·88	3·46	4·04	4·62
1¾	·63	·94	1·26	1·89	2·52	3·15	3·78	4·41	5·04
1½	·73	1·10	1·47	2·20	2·94	3·67	4·41	5·14	5·87
2	·84	1·26	1·68	2·52	3·36	4·20	5·06	5·88	6·72
2¼	·96	1·41	1·89	2·83	3·78	4·72	5·66	6·61	7·56
2½	1·05	1·57	2·10	3·15	4·20	5·25	6·30	7·35	8·40
2¾	1·15	1·73	2·31	3·46	4·62	5·77	6·93	8·08	9·24
3	1·26	1·89	2·52	3·78	5·04	6·30	7·56	8·82	10·08
3¼	1·36	2·04	2·73	4·09	5·46	6·82	8·19	9·55	10·92
3½	1·47	2·20	2·94	4·41	5·88	7·35	8·82	10·23	11·76
3¾	1·57	2·36	3·15	4·72	6·30	7·87	9·45	11·02	12·60
4	1·68	2·52	3·36	5·04	6·72	8·40	10·08	11·76	13·44
4½	1·89	2·83	3·78	5·67	7·56	9·45	11·34	13·23	15·12
5	2·10	3·15	4·12	6·30	8·40	10·50	12·60	16·70	17·80
6	2·52	3·78	5·04	7·56	10·08	12·60	15·12	17·64	20·16

All the preceding tables are indispensable in estimating the weight of gasholders, roofs for retort-houses, coal stores, or other structures of wrought iron.

Gasholders of small dimensions are generally constructed with their sides of No. 16 gauge sheets, and the top or crown of No. 14 or 15 gauge; but as these vessels increase in magnitude, the sheets are sometimes increased in thickness, according to circumstances. Where capital is limited, holders of 60 or 70 feet in diameter are often made of the thickness indicated, except, perhaps, the sheets which are rivetted to the bottom and top angle-iron, these being augmented in thickness by one or two numbers of the gauge. It is, however, very false economy to construct holders of light material. The durability of a holder, under average conditions, constructed of No. 16 gauge, may be 25 years; whereas, by the addition of another pound per foot to the thickness of the metal, its duration may be fairly estimated at double that period.

But it is not only upon the proper construction of gasholders that their durability depends. Another important consideration is the adoption of means to protect the iron against the action of the water, and the impurities of the gas with which it is contaminated. For this purpose the ordinary oil paints are insufficient, and, from experience, we believe that a good coating of pitch, mixed with tallow, is the best preservative for the iron employed in a gasholder. Tallow, for similar purposes, has a most extraordinary conservative action; it does not dissolve, nor chip off, but adheres with remarkable tenacity wherever it is applied, and thus prevents oxidation.

A single holder, without being counterbalanced, when charged with gas, displaces a quantity or column of water equal to its weight, minus the difference between the weight of gas it contains and a like volume of air; or, in other words, less the ascending power of the gas, which may be estimated (according to its specific gravity) as averaging about 40 lbs. for each 1000 feet contained in the vessel. Thus, in a holder of 50 feet in diameter, and containing, say, 30,000 cubic feet, the gas has an ascending power of about 1200 lbs. It follows, therefore, that the weight of a column of water displaced by the holder, or its pressure, being known, the approximative weight of the vessel is obtained. For the purpose of this calculation, the weight of a cubic foot of water, which is 62½ lbs., may be taken as the basis, each inch of which is equal to 5·2083 lbs. Hence, a small experimental gasholder, of exactly 1 foot area in horizontal section, weighing 5·2083 lbs., will give 1 inch pressure; but if the area be doubled, and the same weight retained, the pressure will be diminished to 5-10ths of an inch, or, if we increase the weight of the holder, but retain the same area as before, the pressure will be augmented proportionably. For the practical application of this rule, if we suppose a holder say of 50 feet in diameter, the area of which is 1963·5 feet, and weight 40,904 lbs., then the weight being divided by the area gives 20·8332 per square foot; therefore, as 62½ lbs. represent a column of water 12 inches high, and of an area of 1 square foot, therefore 20·8332 on the same area will be equal to 4 inches, or the pressure desired.

Reversing the proposition by having the area and pressure of a holder, its weight can be determined, and for the sake of simplicity we retain the dimensions of the vessel just referred. The area of this being 1963·5 lbs., and its pressure 4 inches, then as each square foot represents 20·8332 lbs., the area being multiplied by this gives 40,904 lbs. as the weight of the holder.

Or the weight and pressure being known, the area of the holder may be ascertained by dividing its weight by the column of the pressure. Thus 40,904 lbs. divided by 20·8332 lbs., the weight of a column of water 4 inches high, gives 1963·5 feet as the area. This rule, which is of the greatest simplicity, is also alike useful for constructing experimental gasholders, regulators, and for ascertaining the weight of counterbalance for holders, &c.

In Mr. Newbigging's "Handbook" exists, amongst other very instructive matter, a table of the weight of gasholders of different diameters, for each tenth of pressure, from 20 to 200 feet, based on the calculation mentioned; which table is of the greatest utility to all interested in the construction of gasholders, and may be relied on for its strict accuracy.

When ascertaining the approximative weight of gasholders by this method, the ascending power of the gas must be taken into consideration, for this, as shown in a holder 50 feet diameter, is equal to 1200 lbs., or rather more than its weight in pounds at a tenth pressure.

The pressure of a holder varies slightly according to its position, or the degree to which the sides are immersed; this, with single holders of ordinary construction, is very insignificant, and practically need not be taken into consideration.

Telescopic holders were first brought into requisition in consequence of the extremely limited space occupied by the early gas-works, situated, as they were sometimes, in the heart of a city, in the midst of most populous neighbourhoods, and where ground had to be purchased at fabulous prices.*

But the increasing demand for gas, and the necessary enlargement of these vessels, have rendered the telescopic system indispensable in an economical point of view, as the cost in the construction for a given capacity is decreased very materially, and telescopic holders are, therefore, adopted in some of the most extensive and modern constructions. Our general observations of weight, &c., apply equally to telescopic holders, but, as their lifts are provided with water-lutes, these add slightly to the complications in estimating their weight; and, as they contain water for the seal, considerable counterbalance weights are necessary. As we proceed, various constructions of these holders will be referred to.

So far we have entered into the generalities connected with the formation of gasholders—having briefly stated the gradual progress of their construction, details connected with the materials of which they are made, as well as the causes and effects of pressure—and we now propose to enter into the engineering considerations in connexion with the subject.

(To be continued.)

Death of the Manager of the Stratford-on-Avon Gas-Works.—We have received information of the death, on the 6th inst., of Mr. Henry Cranmer, after a short but severe illness. Mr. Cranmer had been for many years the manager of the Stratford-on-Avon Gas Company, the duties pertaining to which office he had fulfilled with the strictest uprightness and integrity, and to the utmost satisfaction both of the company and of the townspeople generally. A local paper, recording his death, remarks, that "as a self-taught man, he had by unflagging industry acquired such perfect knowledge of the principles and economy of gas production, and had made himself so completely master of the various engineering difficulties frequently met with in its practical application, that his counsel and advice were eagerly sought after by all who were desirous of establishing works of a similar character, not only in towns belonging to our immediate district, but frequently at places far distant; and we feel sure that, next to his widow and family, his loss will be by none more deeply deplored than by the managing committees with whom he has been so intimately connected during the comparatively short period of his useful career amongst us." He was 53 years old at the time of his death.

Testimonial to Mr. W. Moss.—On Thursday evening last, a gathering of the men employed by the South Metropolitan Gas Company was held at the lecture-room on the works, for the purpose of presenting a handsome testimonial to Mr. William Moss, an esteemed servant of the company, who, after holding various positions of high responsibility during a great portion of a period of 37 years spent in the service, is about to retire upon a well-merited pension. The testimonial consisted of a handsome marble timepiece, manufactured by Bennett, of Cheapside, and valued at £22, and bore upon it the following inscription: "Presented to Mr. William Moss, by the men under his charge at the South Metropolitan Gas-Works, on his retiring from office, March, 1875." Mr. Moss, in acknowledging the gift, most heartily thanked those who had so kindly shown this proof of their goodwill towards him and his. He said he had always found his men ready and willing to help him in any emergency, and he was proud and happy to look back upon his long connexion with the works, where there was to be found a good manager and good men. He hoped his successor would be well received by the workmen, for he believed they had the men's interest at heart as well as the masters, and that was the great thing. He knew them to be sensible men, who would only ask and expect what was just and fair.

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* The City of London Company's first works were erected in a yard in Fetter Lane; but the company being threatened with legal proceedings, they were reluctantly removed in 1814 to their recent site.

Correspondence.

FORM OF GAS COMPANIES ACCOUNTS.

SIR,—If your correspondent, "A. B.," will carefully peruse the following golden rule, he will find no difficulty in applying the principles of "Debit and Credit":—

"By journal laws, what I receive,
Is debtor made to what I give;
Stock for my debts must debtor be,
And creditor by property.
Profit and loss accounts are plain,
I debit loss and credit gain."

Supposing a company's accounts to be kept correctly, the "share capital" will be "credited," and the "fixed plant" will be "debited;" the "debit balances" will be "assets," and the "credit balances" will be "liabilities." A balance-sheet represents nothing more nor less than the united debit and credit balances; but, in the construction of such balance-sheet, the "debits" become "credits," and the "credits" become "debits;" for the simple reason that, in the balance-sheet, the "company" is "debited" and "credited," whereas, in the books, "persons" and "things" are "debited" and "credited."

The sides of the profit and loss account are never reversed, it is always "debit loss" and "credit gain."

60, *Cornhill, March* 12, 1875. ALFRED LASS.

SIR,—The method adopted by "A. B." (JOURNAL, March 9), of charging expenditure of capital to the debit of capital account, and of giving the same account credit for receipts, is the correct mode. It is a proper application of the rule, that everything received is debtor to its source of origin, and the origin is debtor to the thing received for the account of its appropriation, and the reverse.

Here that which is received is cash, and its origin or reason of its being required is the want of capital by the company, hence the propriety of the following mode of entry:—

Dr. *Cash Account* *Cr.*

To Capital acct. for call received from John Evans, £2 per share, 75 shares	£150	0 0	To Capital acct. for payments made to Richard Swice for retorts	£25	0 0
			To John Edwards for iron-pipes	78	15 6
				£103	15 6
			By Balance.	46	4 6
	£150	0 0		£150	0 0

Posted thus—

Dr. *Capital Account.* *Cr.*

By Cash paid for retorts' . .	£25	0 0	To Cash for call received from shareholder	£150	0 0
Cash paid for iron-pipes. .	78	15 6			
	£103	15 6			
Unexpended capital. . .	46	4 6			
	£150	0 0		£150	0 0

Hill Fields, Arley, Bewdley, March 12, 1875. WILLIAM DORÉ.

TESTING THE ILLUMINATING POWER OF COAL GAS.

SIR,—I trust you will pardon my troubling you with this communication, but as there is some probability of the vexed question of "test-burners" once more being made the subject of parliamentary inquiry, as a matter of course the attention of most of those engaged in photometric experiments will be called to the matter. I would, therefore, venture to suggest whether this may not be an opportunity when the whole question of gas photometry might undergo revision. I believe I am stating the opinion of many of my professional friends, in saying that the present mode of ascertaining the illuminating power of coal gas is anything but satisfactory. All who are at all acquainted with optical experiments must be fully aware how unreliable such experiments are, if merely dependent on the capacity of the eye to register or determine any process where lights of varying intensities are being operated with, and how many errors may creep in in all observations made under circumstances so unstable as the consumption of the material of a candle. I have had personal experience which confirms this statement, for nearly eight years, while in charge of a gas-work abroad. I was compelled, under the police regulations, to make four sets of experiments every 24 hours; oftentimes I have found candles that would vary as much as 10 per cent. in their rate of consumption, and were equally irregular in illuminating power; it would, therefore, have been obviously unfair to take such tests as anything but mere approximations of the value of the gas I was supplying. Not only is the standard candle an unreliable basis, but oftentimes a still greater source of error is the mode of manipulating. The colour of the image on each side of the paper disc will vary considerably, and the effect of these variations on the eye of the operator often leads him to very false conclusions. In fact, the objections that might be urged against the present system are more numerous than at first sight appear possible; but if the subject is investigated impartially, they will all be found capable of being substantiated.

If what I have said be true, then will come the questions—How can these defects be remedied? or, What can be substituted for the present method of testing? To such questions I would answer—that the only absolutely reliable tests are a series of carefully made quantitative analyses, but these would be objected to as being too tedious and too expensive; then the next most reliable test would be the comparison of the gas flame with a lamp burning a fluid of known chemical composition (such as was proposed some years ago by Mr. W. Crooke, the eminent experimentalist), the actual value of these flames might then be determined by the aid of a polarizing apparatus. I know many experiments have been made, and the average variation in the values of the standard flames have not exceeded 1 per cent. when proved by the polarizing process.

But I am sanguine enough to believe that sooner or later the beautiful arrangement of the spectroscope will be adapted to the process of analyzing gas, and that by its aid we shall be enabled to ascertain the value of any illuminating agent by dealing with the structure and constituents of the various flames directly, and not, as is the case now, be under the necessity of comparing them with some secondary imperfect standard.

Every suggested improvement, I think, is worth careful consideration, so as, if possible, to put an end to the present anomalous state of things, which is the fruitful cause of so many conflicts between the consumers and manufacturers of gas. I cannot help thinking it would be as much to the interest of gas companies as it would be beneficial to the public, that gas, like every other article of trade, should be sold at its true commercial value, and not on the fictitious basis as is now too frequently the case.

9, *Islip Street, Kentish Town, March* 11, 1875. HENRY GORE.

PLYMOUTH GAS COMPANY.

SIR,—Referring to your editorial remarks in the JOURNAL of the 23rd ult., allow me, as a party rather interested in the Plymouth Company, to state, for the information of your readers, that originally the United General Gas Company supplied Plymouth, Stonehouse, and Devonport with gas, their works being at Millbay, subsequently occupied by the Plymouth Foundry Company. The gas at that time, I believe, was poor in quality and deficient in quantity. An opposition company was started, entitled the Plymouth and Stonehouse Gas Consumers Company; they obtained their bill, and built their works on the present site at Coxside, *at their own expense*. Eventually the original company was bought up by the new one, who were compelled to abandon the old works (which remained for years unlet), and, in addition, extend their works to meet the requirements of the town, and were compelled for some years to work a double set of mains.

Taking these facts into consideration, I cannot see that they profited much from "diminishing the amount of capital," but *vice versâ*,

In conclusion, I beg to hint that had the credit been given to "*good management*," instead of the erroneous version of extraneous help, it would have solved the mystery, and been considerably nearer the facts of the case. A PLYMOUTH EX-OFFICIO.

SIR,—I am sorry to find, from a letter which appeared in last week's JOURNAL from Mr. G. Henderson, that I misstated the *source* from which the capital of the Plymouth Gas Company, which is not dividend-bearing, is derived. I founded my statement on what I believed to be reliable information, or I should never have given expression to it. As I was misinformed, I can only express my regret, which I shall feel obliged by your inserting in your next issue.

Ipswich Gaslight Company, March 15, 1875. E. GODDARD.

BRICK RETORTS.

SIR,—Your correspondent, Mr. A. Gibb, "anxious that honour should be given to whom honour is due," asked in the JOURNAL of the 16th ult. who was the inventor of "brick retorts." Mr. Hassal, in the number for the 2nd of March, conferred the honour on Mr. Parsons, sen., of Birmingham. I am not in a position to refute that statement, but my opinion is that the original inventor of "brick retorts" was the late Mr. Thos. Foxall, formerly engineer of the Halifax Gas-Works.

"Brick retorts" were in use at the Halifax works 35 years ago, and probably before that time, to which his son, Mr. Wm. Foxall, may testify. Since then very many improvements have been introduced in their construction, and their great durability has long been established, while the consumption of coke, which has often been discussed at our annual meetings, is little (if any) in excess of clay retorts.

Elland, March 10, 1875. ROBT. DEMPSTER.

Parliamentary Intelligence.

HOUSE OF LORDS.

TUESDAY, MARCH 9, 1875.

A report was read from the Select Committee on the Barrow-in-Furness Corporation Bill, that they had not proceeded with the consideration of the bill, no parties having appeared in opposition thereto.

HOUSE OF COMMONS.

MONDAY, MARCH 8.

The Chelsea Water, and Longwood Gas Bills were read a second time, and committed.

Report on petition for additional provision in the Rochdale Improvement Bill, that the Standing Orders have been complied with, was presented, and the committee on the bill were instructed that they have power to make provision therein accordingly.

The further Standing Order applicable to the Newport (Monmouthshire) Gas Bill has been complied with.

A petition for alteration in the Municipal Corporations (Borough Funds) Act was presented from Reading.

Petitions against The Gaslight and Coke Company Bill were presented from (1) Imperial Gaslight and Coke Company, (2) Corporation of the City of London, (3) Metropolitan Board of Works.

The petition of the London and North-Western Railway Company against the Ashton-in-Mackerfield Local Board Bill has been withdrawn.

Sir JAMES HOGG gave notice that on the second reading of The Gaslight and Coke Company Bill he will move—"That it be read a second time upon this day six months."

Mr. COOPE gave notice that on second reading of the Metropolis Water Supply and Fire Prevention Bill, he will move—"That it be read a second time upon this day six months."

Sir GEORGE JENKINSON gave notice that on an early day he will ask the President of the Local Government Board whether, having in view the very inadequate supply of water for drinking and other purposes in many towns, rural villages, and districts throughout the country, Her Majesty's Government are prepared during the present session with any measure to remedy this great and growing evil; and if not, whether the Government will consent to an inquiry into the subject, either by a Royal Commission or by a Select Committee of this House.

TUESDAY, MARCH 9.

The Cleveland (Skelton) Gas, and Heckmondwike Gas Bills were reported.

The Imperial Gas Bill was read a second time, and committed.

ACQUISITION OF GAS AND WATER-WORKS BY LOCAL AUTHORITIES.

Mr. COLMAN: I beg to ask the President of the Local Government Board whether it is the intention of Her Majesty's Government to introduce a bill during the present session, for better enabling municipal corporations or sanitary authorities to acquire gas or water works; and whether the Local Government Board have made any recommendation thereon.

Mr. SCLATER-BOOTH: It is not the intention of the Government to introduce any special measure this session for the objects referred to in the question of the honourable member. But perhaps it may be convenient to the House for me to state very shortly what is the present position of the matter, and what alterations the Public Health Bill proposes to make in the law. Under the

existing law, the sanitary authorities can purchase water-works, or provide them when there is no company able or willing to supply water. The Public Health Bill will extend these powers, by enabling the local authorities to carry water-mains to adjoining places. At present the sanitary authorities have no power under the general law to construct or to purchase gas-works; they have only to provide and to light the public lamps. The bill will enable them to purchase gas-works by agreement; and where there is no company a Provisional Order may be made, giving them authority to establish gas-works in a district.

WEDNESDAY, MARCH 10.

On the motion of Sir CHARLES FORSTER, the order, "that the Wakefield Water Bill be committed," was read and discharged. Bill withdrawn.

On the motion of Sir CHARLES FORSTER, the minutes of evidence taken before the committee on the Wigan Water Bill, in session 1860, were referred to the committee on the Ashton-in-Mackerfield Local Board Bill.

The Carmarthen Gas Bill was reported.

Petitions in favour of the Pemberton Local Board Bill were presented from (1) Orrell Local Board, (2) Owners and Ratepayers of Orrell.

A petition against the Barton, Eccles, Winton, and Monton Local Board Bill was presented from ratepayers of Barton, Eccles, Winton, and Monton.

The petition of the Corporation of Truro against the Truro Water Bill was withdrawn.

THURSDAY, MARCH 11.

A petition in favour of the Barton, Eccles, Winton, and Monton Local Board of Health Bill was presented from millowners, &c., in the Barton district.

FRIDAY, MARCH 12.

The Leicester Water Bill was reported.

The petition of the Great Western Railway Company against the Neath District Water Bill was withdrawn.

SATURDAY, MARCH 13.

The petition of the London and North-Western Railway Company against the Oldham Corporation Water Bill was withdrawn.

HOUSE OF COMMONS COMMITTEE.

TUESDAY, MARCH 9.

(*Before Admiral* EGERTON, *Chairman; Mr.* ASSHETON, *Viscount* NEWPORT, *and Mr.* HOPE-JOHNSTONE.)

CARMARTHEN GAS BILL.

Serjeant SARGOOD and Mr. MICHAEL appeared for the promoters; Mr. LITTLER, Q.C., and Mr. PHILBRICK, Q.C., for "owners, lessees, and occupiers of property and consumers of gas," petitioners against the bill.

Serjeant SARGOOD, in opening the case, said this was a bill brought in by the Carmarthen Gas Company, and the two main objects of the bill were to increase the capital and the price per 1000 feet of gas. There were other matters also contained in the bill which were usual in gas bills, about which he need not trouble the committee. There were regulations as to the illuminating power and pressure, and there was a special clause put in to facilitate the Corporation of Carmarthen in acquiring the property of the gas company, "if hereafter they should be so minded." There had been an expression of opinion on the subject, to which he would call attention in the course of his opening address. The history of the company was this. From 1821 until 1870 it was a private undertaking, subsisting under a deed, but without any statutory power or obligations connected with it. In 1870 an Act was passed incorporating the company. In 1869, prior to the Act being passed, there had been a good deal of agitation on the part of the consumers, on whose behalf a bill was deposited for the purpose of getting up a rival company, of course these agitations were always a species of coercion on an existing company—he did not say an unfair one—but pressure was put upon the company by a threat to establish a foreign company, and in the end the deposited bill on behalf of the consumers was withdrawn, the present company undertaking to apply for, as they subseqnently did, their Act of 1870. The old company was incorporated by the Act under the title of "The Carmarthen Gas Act 1870." And the preamble stated that the value of their property as on the 1st of January of the year was £8000, to be divided into 320 original shares, and there was a provision that additional capital might be raised to the extent of £6000, either by new ordinary or preference shares, whichever might be chosen, of the equal value of £25. By section 25 of that Act the dividend was regulated in this manner—upon the old capital of £8000, 7½ per cent.; upon the new capital, if by ordinary shares, 7 per cent., and if by preference shares, 6 per cent. By clause 27 there were mortgage borrowing powers to the extent of £2000 in the first instance, and a further sum of £1000, which was restrained until the £6000 new capital should be subscribed. By clause 29 there was a provision for raising money by debenture stock, the interest of which was limited to 5 per cent., and by clause 58 the maximum price was fixed at 4s. 6d. The Act of 1870 was founded upon the Neath Gas Act of 1866, which was considered to be a very good model on behalf of the consumers, with the exception of some deviations in figures which the difference in position rendered necessary. The directors of the old company were still connected with the present company, and were men of the very highest respectability. Among them were Mr. Morris, who was the member for the borough, Archdeacon Williams, Mr. Lewis Morris, solicitor, and other gentlemen who were interested in the prosperity of the borough. The leading opponents in the consumers agitation were also gentlemen of the highest respectability. Principal amongst them were Mr. Warren, who was chairman of the consumers committee; Mr. Thomas, the town-clerk; Alderman Thomas, and other gentlemen who were interested in the welfare of the town; and, although not immediately or necessarily coupled with those three gentleman, there was another gentleman, by the name of Morgan, the proprietor of a local paper known by the name of the *Welshman*. Those four gentlemen at the time of the agitation formed a committee on behalf of the consumers to correspond and communicate with the then existing company, with a view to arrange for the withdrawal of the consumers bill, and the promotion of the new company, and to go to Parliament to ask for parliamentary powers under the bill which was practically obtained by them in 1870, and was passed through Parliament without opposition. Three out of those four gentlemen who formed the committee—namely, Mr. Warren, Mr. Thomas, the town-clerk, and Alderman Thomas—were invited to join the existing board of the company. They accepted the invitation, and qualified themselves by taking up shares, and from that time down to the present they had worked harmoniously with the directors of the company in making every effort to carry on the business and objects of the company with due regard to the interests of the shareholders on the one hand, and the interest of the consumers on the other. He excepted Mr. Morgan, because when invited he did not join, and he (Serjeant Sargood) should be obliged to ask that gentleman himself for the reasons which he had given at a public meeting why he did not become a director of the company. Probably if he had been a director at the commencement everything would have been looked at *couleur de rose;* but, as a consumer, perhaps he looked at things in another light. The present capital of the company consisted of the original £8000, which was stated to be the value of the property in 1870; of a further sum of £2000, which had been raised under the mortgage powers at the rate of 4 per cent.; and of a further sum of £2000 which had been raised under the powers in section 29, called debenture stock, at 5 per cent. This £200, had been raised in entire misconception and error. The £2000 raised on mortgage, plus the £8000 of old capital, raised the sum to £10,000. The great difficulty under which the company at present laboured was, that they were crippled for want of means to extend and carry out their works, and the idea of raising any capital at the present time at the 4s. 6d. price of gas, the result of which in its working had been an absolute loss, would be quite unfair. Therefore, in asking for leave to get further capital, the company must also ask for the sanction of the committee to pay such a rate of dividend upon it by the sale of their gas as would induce people to advance it; otherwise the whole machinery would collapse. The 4s. 6d. was based upon the Neath Gas Act of 1866; and in the evidence in support of that Act, in reference to the regulation of price, the committee had the advantage of hearing what was said by Mr. Hussey Vivian, a member of the House, and a very large coal-owner, who was supplying coals in the immediate neighbourhood of Neath, and who intimated to the committee (and he was well warranted in so doing) that there was a supply of coal at hand, the extent of which it would be almost impossible to exaggerate; and the price at which he was prepared to supply them with that coal was 8s. 2d. per ton, less a discount of 2½ per cent. for cash; 8s. 2d. per ton with an apparently inexhaustible supply from the hands of that gentleman, induced him to say that he thought at the time 4s. 2d. would be a fair maximum price for Neath. The Carmarthen Gas Company were rather more remote from the coal-fields, and could not be expected, at a distance of 40 miles, to get coals precisely at that price. The price of the gas, therefore, was fixed at 4s. 6d. per 1000, but there was an idea that coals within a few miles would be accessible at a reasonable price. After the passing of the Act of 1870, instead of 8s. 2d. the company paid 13s. 6d. In 1871 they had to pay 14s. 9d.; in 1872, 15s. 9d.; and in 1873, in consequence of the pressure which had been felt all over the country, the price was as high as 27s. 11d. a ton; and last year, there being a slight amelioration, they were obtained for 24s. 11d., but at present they were paying 26s. What the company at present asked was that they should be enabled to charge a maximum rate of 6s. per 1000. The Neath Company applied to Parliament in 1873; and although close upon the collieries, they got an extension of price to 5s. 6d. and to 6s. outside their district; but although Parliament did authorize that sum, the noble lord who had control of these things elsewhere thought fit to cut off the extra 6d. for the outlying district; and although Parliament told them that they might go on without limit of time, the noble lord thought fit to limit them for 12 years. Last session there were two or three other companies which came for relief, all of whom obtained it. In regard to the collieries of Mr. Hussey Vivian, a singular catastrophe occurred to them. They were unfortunately flooded, and practically, for all purposes of trade, they became extinct. They were collieries, he believed, of enormous magnitude, the probable supply of which it would have been impossible at the time to over-estimate; but, practically, they were entirely gone. The company were now, like other companies, obliged to get their coals whence they could, and had to pay, he had almost said, whatever price the owners chose to ask for them. The quality of Mr. Hussey Vivian's coal was unique in the district, and no coal so suitable, at whatever price, could be obtained. There was therefore strong ground for asking the committee to raise the maximum price. Moreover, the effect of the advanced price of coal had been, that in 1873 the works were carried on with a result of £450 to the bad, so that instead of earning a dividend the company earned a loss. In fact, the actual cost of coal per ton, with regard to its manipulation, was greater than the amount earned by it. The time had now fairly come when the company not only might come to Parliament with a good face, but was bound to come, if the works were to be carried on, and ask to be put in future upon such a basis as would enable them to discharge their duty to the shareholders and the public. There was a tendency now-a-days to think that gas companies were established for the benefit of the public, and not like other joint-stock companies, for the benefit of those who provided the needful capital. In coming to a decision, the committee, he assumed, would first ascertain the amount of capital that would be fairly and properly required by the company, and then how much per 1000 manufactured gas delivered to the consumer cost the company, to which would have to be added the dividend sanctioned by Parliament on additional capital. Those two sums added together would represent the price which the company might fairly ask Parliament to sanction. Evidence would be given with regard to those points, and it would, he believed, be seen that the company was justified in asking the Committee to fix 6s. as the maximum price. It appeared from the statements in the bill that the present capital of the company consisted of £8000 the company borrowed on mortgage, and now owed another sum of £2000; and, instead of additional capital, debenture stock had been created. This had been done under a misapprehension on the part of the gentleman advising the company, who thought that money might be borrowed on debenture at 4½ or 4½ per cent., and that it would be better to adopt that course than to raise the money on shares at 6 or 7 per cent., or even on mortgage at 5 per cent. He did not remember that the Gas Company's Act incorporated the provisions of other public Acts, and, amongst others, the special provision that the exercise of the right to get money on debenture to the extent to which it was used nullified the power of getting money in any other way. The money, therefore, had been borrowed without any parliamentary authority, and it was desired that that part of the debt should be extinguished, or that the holders of debentures should exchange them for shares. Possibly the legal adviser might have been impressed with the popular belief that it was the duty of those who provided capital to work a public company to make as little profit as they could, instead of as much as they might; at any rate, he had committed an error of judgment which it was now sought to rectify. The bill sought power to raise additional capital, not exceeding in the whole £10,000, repealing the clause relating to additional capital in the Act of 1870, instead of simply asking for a supplemental sum. The dividend on the share capital was to be limited to 7 per cent., and on the preference stock to 6 per cent., and power was given by the bill to give to the debenture bondholders shares to a like amount, not exceeding £2000. The maximum price was fixed at 6s. per 1000; the quality of gas to be 14 candles. Of the total capital of £12,500, £2000 was for debenture, £2000 to pay debts, £1000 for additional working capital, £1200 for legal and parliamentary expenses, and £2000 for new retorts and mains. That would leave about £4000 as a margin of capital not to be instantly raised. That was as small an amount as could be well asked for, having regard to the fact that it was not desirable to come to Parliament oftener than once in ten years. With regard to the history of the undertaking, he might mention that Mr. Morgan, the editor of the *Welshman* was invited to join the direction, but he failed to qualify himself by taking the requisite shares, and, as soon as notice of the bill was given, he convened a meeting of ratepayers at the office of his paper, and incited the public mind on the subject by articles in the journal. A requisition was afterwards signed, calling upon the mayor to convene a public meeting, at which the question might be discussed. At the meeting three resolutions were passed—first, that it was desirable that the corporation should become owners of the gas-works; secondly, that if the corporation agreed to purchase, the company should be asked to withdraw their bill; and thirdly, that if the company would not withdraw the bill, the meeting pledged itself to oppose it. Subsequently, on the 10th of February, the corporation met, and passed a resolution that, in their opinion, it was desirable that they should become the owners of the gas-works. They were urged to go further, and threaten to oppose the bill if the company did not assent, but they declined to do so. They were not prepared to take active measures at present; they simply thought it desirable that they should purchase the works; and, accordingly, a clause was inserted in the bill to the effect that, if the corporation were willing to come to an agreement, or to go to a fair arbitration, the company would not oppose it. A similar clause was inserted in the Llanelly Gas Bill of 1874, the

corporation having in that case expressed a desire to purchase the works, but had not taken any steps for that purpose. It was to be understood that the corporation were not to buy within three years. It would not be fair to come upon the company under circumstances of great pressure, when it was working at a loss. If the 20 years purchase system were now adopted, the company would simply have to pay to the corporation a large sum of money for the privilege of being purchased, seeing that there were no profits, but only losses. That arrangement would, of course, be an absurdity. With regard to the opposition to the bill, there was one petition of "owners, lessees, and occupiers of property, and consumers of gas." To the extent to which they were gas consumers, they were, of course, interested in getting the gas as cheap as possible, regardless of the cost to the company. The petitioners objected to any alteration in the arrangement as to the maximum price which they said was entered into between the company and the public, and was sanctioned by Parliament after careful investigation. That statement was a mere myth. They had agreed to take the Neath Bill as a model, subject to a slight raising of the price; and 12s. 3d. was at that time the price of coals. The petition stated that the company was formerly a private partnership, and charged what it pleased. That was, of course, the case with every private partnership; it got what it could, the price being regulated only by the question of supply and demand. There was then a complaint that very large profits were made, and that the amount was kept secret from the public. But all traders who were not bound to disclose their books, generally kept their secret; and why a gas partnership should do otherwise he did not know. The petitioners then urged that it would under all the circumstances be unjust to charge more than 4s. 6d. per 1000. Could anything be more absurd? It was contended that all risks arising from the increased price of coal and labour ought to be borne by the company, and that the public ought not to be obliged to maintain the dividends of the company during exceptional periods. That was contrary to the whole spirit of legislation, which in the case of the metropolis gave a right to the companies and the consumers to ask for a modification in the price of gas according to the price of coals and labour. If the company could have got coals for nothing, would not the public have agitated for a reduction? Could it be supposed that a gas company would, like a party of philanthropists, consent to sink £500 or £1000 for the benefit of the town? People took shares in gas companies in order to get a return for their money. It was true that a monopoly was granted, subject to the restriction that the public should not suffer; but it was never intended that the public were to get gas for nothing, at the expense of the shareholders. There was then an allegation in the petition that, if the company had not of late been making large profits, it was owing to bad management; but no specific bad management was alleged, so that he did not know how to meet that charge. It was further asserted that the financial condition of the company ought to be strictly inquired into. To that the promoters had no possible objection, and they would afford the committee and the petitioners the opportunity that was desired. It was finally stated that it would be for the benefit of the public for the supply of gas to be in the hands of the corporation, and that the corporation should have power to purchase the works at once "at such a price as might be fair and equitable, having regard to their present financial position." The corporation, however, had expressed no such wish, and the petitioners had no right to speak in their name. As to the petition itself, no doubt many persons were induced to sign it in the expectation of getting cheap gas; but he did not imagine that a tenth part of the persons so signing had read it or understood its real import. If they had, they would never have come to Parliament to advocate doctrines so monstrous as those which the petition contained.

Mr. *John Thomas*, examined by Mr. MICHAEL.

I am an alderman and justice of the peace, and have been three times mayor of Carmarthen. I am a director of the company, and have been connected with it for a long time. In 1870 a committee was formed to consider the clauses of the bill which was then promoted by the company. I was then representing the Town Council, and acting in the interests of the public, in seeing that proper provision was made for the public lighting. I joined the company at the time. The bill of 1870 was shortly afterwards obtained, and I then became a director. The directors acted very cautiously during the first year, and laid down some mains, and in July, 1871, they called in the assistance of Mr. Cocker, who acted as their consulting engineer, and who recommended an entire reconstruction of the machinery. In 1871 and 1872 a condenser, scrubber, purifier and other things were provided, and the directors proceeded generally, upon the recommendation of Mr. Cocker, to put the works in a proper condition. I have given a general attention to the works, but since December, 1873, I attended to the company's affairs very closely indeed. The price of coal in the early part of 1870 averaged 13s. 3d. I became alarmed in 1873 at the high price of coal, which was 28s. a ton, being rather more than double what it was when the Act was obtained. It was obtained from the Bryndw Colliery, which is about 60 or 70 miles from Carmarthen. We supply 14-candle gas, and, in our opinion, go to the best market possible for our coal. I supervise the contracts for coal, the sale of coke and other residuals. Supposing circumstances to continue as they are, I cannot see how we can conduct our works at a profit. We are now charging 4s. 6d. per 1000 feet. In 1873 the coal cost us a little more than we obtained for the gas—in point of fact, £1000 more than it did in 1871. Since the passing of the Act in 1870, we have paid, in 1871, 2½ per cent.; in 1872, 1½ per cent.; and in 1873 there was a loss of £450. In 1874 there was a nominal gain. During the whole time we had not a single farthing for depreciation, and we had no reserve-fund at all. There was nothing to meet contingencies that might occur in the conduct of the works, or to equalize dividends. In point of fact, there was no dividend, and therefore there was nothing to equalize. The price of coal in our district, besides wages and other materials, has increased in cost. There have been advances on the wages of our men, which would influence the price of gas to a considerable extent. We put a greater stress, however, on the increase in the price of coal. In 1871 the average price of the whole of the coal we bought was 14s. 9d.; in 1872, it was 15s. 9d.; in 1873, 27s. 11d.; in 1874, 24s. 11d. I have made a calculation, and up to the beginning of last December the average price was 22s. 6d. In December and January we got our coal at 20s. per ton, but since February we have been paying 26s. There is a great disturbance in the coal supply in our district. In 1873 the entire cost of coal for the conduct of the works was £2249 6s. 9d. The total amount we received for the supply of gas was £2248 10s. 9d. In point of fact, we received a good deal less than that, because in the case of public lighting we should have to make an allowance of about £60, since we had no trouble of collection. We were landed in a loss of £450, which was the net result of the year's working at 4s. 6d. per 1000. During the time I have been connected with the company I have exercised supervision over the works, and, to the best of my ability, can say they are conducted on sound commercial principles. In June, 1874, we had a nominal profit of £70. The works have been conducted without cost to the shareholders. We have taken no fees as directors in any shape whatever. Previous to 1870 a valuation of the works was made by a competent engineer from London. By the Act of 1870 we were limited to a dividend of 7½ per cent. upon our old capital. I have always understood that 10 per cent. was the usual amount on the primary capital of a gas company, but we cannot, under any circumstances, exceed 7½ per cent. Since 1870 a large amount that we might have received, had the company been in a flourishing condition, has been lost to the shareholders. There has been the difference between 1½ and 7½ per cent., and a difference between 2½ and 7½ per cent.; in fact, there has been a loss of £450. We propose by the bill to raise the capital to £10,000, with the ordinary borrowing power, giving a total capital of £12,500. Our present works cost altogether £14,000; that is to say, £8000 original shares, £2000 mortgage, £2000 debentures, and £2000 due to bankers. £8000 was our original capital. Then we borrowed one-fourth, making a total of £10,000.

Mr. MICHAEL: Were you advised by your solicitor that you could raise debentures for £2000 more?

Witness: Yes; we had to give 5 per cent. for the first debentures. They consisted of two sums of £500 at 5 per cent. The next £1000 we issued to one of our directors. We got him to take 4 per cent., that works out the £2000 at 4½ per cent.; so that there would be a saving to the consumer of the 2½ per cent.

Mr. MICHAEL: Although you have sinned by doing something against the law, it has been in the interest of the consumers.

Witness: It was the only plan]we had; we could not have issued preference shares at that time except at an enormous discount. Our solicitor told us we might borrow on debenture. We would not raise by ordinary or preference shares, and he called our attention to a special clause in our Act, empowering us to create and issue debenture stock, and to attach thereto a preferential interest not to exceed 5 per cent., and we borrowed, thinking that we had a right to do so. Our town-clerk afterwards made discovery that it was an irregular transaction, and we want to rectify it as soon as we can. If the power to raise this capital is granted, I think we can pay off this £2000 debenture. Then we shall require about £1000 of working capital at least. We owe £2000 to the bankers, £2000 on debentures, and £2000 will be required to relay the mains, &c., making a total of £6000. We have entered into a bond of £3000, and owe at the present time about £2100; £1000 in our opinion, as directors, is necessary, as working capital. We shall have to relay a great many of our old mains, as some of them have been in the ground no less than 50 years. If we relay them it will be in the interest of the consumers, seeing it will diminish the quantity of unaccounted-for gas, save leakage, and will thus enable us to supply gas at a cheaper rate. We shall also require increased storeage. Our present holders are three in number, two of them being very old and nearly worn out, and we shall within the next five or six years have to replace them. There will be an outlay of £2000 in increasing our storeage and relaying our mains, which with £1200 for parliamentary expenses will make up a total of £8200. That would leave £4000 as a margin out of the new capital. I consider it necessary we should have a margin of that kind; it can do us no harm, at all events, and we will not raise it unless we need it.

Mr. MICHAEL: Having met your present necessity, you have that as a balance, if your supply increased in the district, to meet the increased wants?

Witness: Precisely so. It is quite true the old company did not publish their accounts, but Archdeacon Williams thought it necessary, a little while ago, to go through the books of the company, with a view to ascertain as nearly as possible what the actual dividends of the old company had been. He gave me the result of his inquiry, and requested me to make an analysis of it. I submitted that analysis to him, and he confirmed it as correct. From that it would appear that the old company was formed in 1821, and that the first nine years it devoted all its profits to the improvement and extension of the works. It started with a trade capital of £4000, which was found to be insufficient, and it was determined not to divide any profits for the first nine years. The archdeacon estimates the actual profits made during those nine years at £2000. Whatever the amount was, it was capitalized, and the whole of it was expended in improving the works. In Sept., 1831, the company declared the first dividend, and for 31 years the aggregate amount of dividends was £225 per £100 share which I worked out as being equal to 7 per cent. on the original capital of £4000, or, supposing there had been an outlay of £2000, it would only be a dividend of 5 per cent. on the £6000. In 1861, the end of the period of 31 years, they expended the whole of the £2000 in providing a new gasholder, in buying some land, and in laying down some additional mains. I worked it out in this way—from 1861, when the second sum of £2000 was expended on the works, to 1870, the year when the Act was obtained, the aggregate dividends were £112 on £100 share capital, which would be at the rate of 6 per cent. upon the £8000, so that an original shareholder received for every £100 invested in 1821, being a period of 49 years, £337 in the shape of dividends, or about £6 15s. on a capital of £4000, so that the total receipts to every shareholder were £437, giving him interest to the extent of £8 10s. or £8 15s. In point of fact, we have reversed the process of capitalization, and made the capitalization work back to the dividend.

Mr. MICHAEL: There is an allegation in the petition that the reason why you had no dividend has resulted not from the increase in the price of coal, but from your bad management.

Witness: I do not believe that. The increase in the price of the coal is quite sufficient to account for that, and if we had had coal from the first at the same price as the old company had, we should in 1873 or 1874 have divided our maximum dividend. [The witness then read from several of the annual reports of the directors to the shareholders, with the view of showing that the backward state of affairs was due to the increase in the price of coal.] I took an active part in 1870 as to fixing the price at 4s. 7d. There was an attempt on the part of the old company to charge us a somewhat higher price, and that was the cause, I think, of the creation of the new company.

Cross-examined by Mr. LITTLER: In all these reports you encourage your shareholders each time by saying that when the works are completed you will have favourable results. You say in the last report the works are complete. How about the favourable results?

Witness: We are working now better than we were—a good deal better than before we erected the new machinery.

Mr. LITTLER: In regard to this new capital, for what reason do you require a new main? Is there an increase in the consumption?

Witness: The mains have been in the ground some 52 years, and we have reason to believe that they will not last very much longer, and that it would be better for us to replace them with new ones. We have had no written reports as to the state of our pipes from our engineer. We have had a rough estimate from him as to their cost. We have had no estimate on paper from him as to the cost of the new holder, but we know that the variation cannot be more than a few hundred pounds in any case. Although Carmarthen is a stationary place, there has been some increase in the consumption of late years. There have been no new works, but the people are burning more gas than formerly.

Mr. LITTLER: And if they have to pay 1s. per 1000 more, they will take less?

Witness: I do not know; the people at Neath pay it cheerfully.

Mr. LITTLER: Apart from the increase in the consumption, your new capital unissued goes a long way towards what you want?

Witness: Nothing of the kind. Our capital is £17,000, and we have already expended £14,000 of that. We estimate the cost of this bill, and other legal expenses, at £1200. We want a working capital of £1000, and the new gasholder and mains will take £2000. That will work up something like £700 in excess of our share capital and borrowing power.

Mr. LITTLER: Have you any working capital at all?

Witness: We have an account with our banker. Now we owe the banker £1700 or £1800 on the capital account.

Mr. LITTLER: Then you have no working capital?

Witness: No. We are overdrawn now to the extent of £400 or £500.

Mr. LITTLER: Then for the last three or four years you have managed to do without working capital?

Witness: We have paid a heavy interest for it—a most improvident thing—and we will try and avoid that again if we can. In regard to the £2000 estimated by the archdeacon, so far as I know there is nothing on the books to

show what it is. The books are silent with regard to the dividend for the first nine years. I believe that in 1870 we used cannel coal mixed with cheap coal, but I am not sure. We laid some mains in 1870. We put in a scrubber, condenser, and purifier in the winter of 1871-2, and they came into operation in March. The exhauster did not come into operation until October, 1873. I have no recollection, during part of the time the coals were at the higher price, of our having bought them from a retail dealer in town. I do not believe we did.

By the COMMITTEE: The population of Carmarthen is about 8500. The borough itself contains a population of about 10,500. There are some suburbs close to the town. Johnstown has a population of 1000. There is another place called Pensarn, which is not in the borough, but Johnstown is. We have got our mains down at Johnstown, and have got them half way over to Pensarn. To the best of my belief, we are supplying gas out of the borough. We have 24 town councillors, 6 aldermen, and 18 common councilmen. We paid the interest on the £2000 borrowed on mortgage regularly, as also the interest of the debentures. I visited the coal district more than once, to see if an advantageous contract could not be made for coals. The directors have exercised the utmost possible economy, and have managed this affair as if it were their own concern. We have used no cannel coal since 1874. My own opinion is that, when there is a revival in the iron trade, the price of the coal in these districts will go up.

The Ven. Archdeacon *Williams*, examined by Serjeant SARGOOD, said he was the Archdeacon of Carmarthen, and a shareholder in the old company. He took one original share in 1820 or 1821. He had heard the evidence of the last witness, and confirmed his statements. The average dividend was 6½ per cent. for 49 years. Whatever the profits had been for the first 10 years, they had been all capitalized in order to provide for the extension and improvement of the works. Although the company had been started for the benefit of the shareholders, it was the only means by which the community could get gas, and the shareholders had been very much pressed by the absence of a return for their money for a good many years.

Cross-examined by Mr. PHILBRICK: The years in which the dividend of 11 per cent. was paid were 1867 and 1868. In 1869 it dropped to 5 per cent. All the dividends that had been spoken of prior to 1870 were dividends declared upon their original capital of £4000. In 1870 the capital was doubled. There was £2000 worth of undivided profits which were capitalized, and so there was a permanent addition of 25 per cent. to the capital. The other £2000 came in as the reserve-fund. Besides the dividends declared, there was a bonus of £1 per share for 10 years. They were also declared in the years the 11 per cent. was paid, making a total of 15 per cent. for those years.

By the CHAIRMAN: The bonus was included in the average dividend for those years.

Mr. *Thomas:* There were 10 bonuses paid between September, 1861 and 1870, and those had been added in every case.

Mr. *Benjamin Lewis*, examined by Mr. MICHAEL.

I am the manager of the gas-works, and have held the position of manager and secretary since 1856. The valuation of the works in 1869 was £7725. It was made by Mr. Clark, of the Imperial Gas Company in London. There was a sum added, which brought it to the £8000 mentioned in the preamble of the bill of 1870. In 1869 the works required to be remodelled. Since that time we have proceeded under the advice of Mr. Cocker, and remodelled the works. They are entirely reconstructed, and are in an efficient condition. The consumption of gas has increased since 1870. There are some works still to be done. The demand for coke at Carmarthen is very sluggish. We have great difficulty in disposing of it, and are obliged to sell it at a low rate. We get our coal from the Bryndw Colliery. We are placed on an anthracite basin. It is a very stony coal, and unfit for making gas. The Bryndw is a bituminous coal. It costs us 4s. more for carriage than from Neath, and 2s. 6d. more than from Llanelly, which is the borough nearest to us. This is the best coal that can be obtained in that quarter. We used cannel coal in 1870, because the coal was not sufficient to produce the illuminating power which the bill made compulsory upon us. We supply 14-candle gas, and there has never been any complaint as to its illuminating power. The pressure we supply is from 14-10ths to 7-10ths. If we diminished the pressure to 6-10ths it would lessen the leakage.

Cross-examined by Mr. PHILBRICK: The quantity of coke we produce per ton of coal carbonised is about 11 cwt. The quantity of gas we obtain per ton averages about 7200 feet. The quantity that passes the station-meter is about 8400 feet, making 1200 feet per ton unaccounted for. I cannot give the per centage of the leakage. There has been a substantial increase in the consumption of gas since 1870. We have about 450 consumers. Of the 11 cwt. of coke, about 50 per cent. is consumed in the works. In small works such as ours this is a fair amount to consume. I am not aware that 33 per cent. is the general allowance in any well-conducted gas company. The reason we discontinued the working of the cannel was because the price advanced so rapidly that we could not afford to pay for it. In 1870 we were paying for coal 13s. 6d., for the cannel 22s. Cannel is now from 30s. to 50s., but the quality of cannel we use costs us now 35s. We use the same coal now as we did in 1870.

Mr. PHILBRICK: So that the object in using the cannel in 1870 was to get sufficient illuminating power?

Witness: Yes. We had no means of testing the illuminating power in 1870. It is now 14 candles. We test with the Letheby burner. I do not know whether, if we were to use the Sugg burner, we should get a better return of the gas, although I know that it will bear a favourable comparison with any other burner that can be used. We made 7500 feet of gas per ton in 1870. Since that time some old mains have been replaced by other mains which would give a larger supply. The leakage has not increased since 1870. I believe Mr. Silverthorne, on the part of the petitioners, put a question to me as to the length of the mains, but I referred to the solicitor of the company. We are now taking our coal at current rates. We buy it as we require it. Our consumption is about 1600 tons. We are supplied weekly at a monthly quotation. We always buy of the same firm. We never contract, but buy the coal at the current rate of the market. These sellers give us the most favourable rate, in consequence of our always purchasing coal from them. For the last 12 months we have been dealing with one firm. We do not supply Pensarn. We go across the river to supply some chemical works, but not beyond.

Re-examined by Mr. MICHAEL: In 1870 we had no photometer. We were anxious to give the supply as provided for by the Act. Finding afterwards, by the photometer, that we supplied 14-candle gas from the Bryndw coal, we thought it was not necessary to use cannel, which is always much more expensive than ordinary coal. We are obliged to give the coke away; therefore the object of using cannel at an increased price was for the purpose of increasing the illuminating power.

Mr. MICHAEL: If you are using a burner which does not give the true illuminating power of the gas, you, as a company, are injured?

Witness: Yes.

Mr. MICHAEL: If science has found out a good burner, that is the one you ought to use?

Witness: Yes. We have been supplied from Bryndw for nearly 30 years. If we could have found a better place we should have gone to it. We have applied to about 50 places about the district, and could not find a better. It is difficult to get that quality of bituminous coal which will make gas properly, and we are shut up to the use of one or two collieries. This is the case in all our district of the principality, because we are on a stone coal district, which is unfit for making gas. In 1872 we received for gas £2036; in 1873, £2248; in 1874, £2519, which shows a continued increase in the supply. The same price was charged in those different years. In 1872 we used 1644 tons of coal; in 1873, 1608 tons; and in 1874, the quantity decreased to 1573, so that there is a much larger revenue arising from the smaller consumption of coal, showing a more profitable conduct of the works.

Mr. MICHAEL: Do you take every means as a manager to work the company economically?

Witness: Quite so.

Mr. *W. Thomas* recalled, and examined by Mr. MICHAEL, said the aggregate amount of dividends, including the bonuses from 1821 to 1870, was £337, which, worked out, was about £6 16s. per cent. on a capital of £4000. He had given, so far as he knew, the total amount received in money by way of dividends by the shareholders up to 1870. The sum of £100, which was allowed to each shareholder in donbling the amount of his share, added to the £337, would make a total of £437 received by each shareholder up to 1870. Dividing that by the 49 years, that would amount to about £8 16s. £100 was the deferred amount of 40 years.

Cross-examined by Mr. PHILBRICK: The company which started in 1821 declared no dividend until 1831. The first dividend declared was in September of that year. In 1861 there was a further outlay of £2000. We have included the 5 per cent. in our last year's dividend. In the 39 years there was one year (1833) in which there was no dividend at all. All the rest had a minimum of 7 per cent.; it rose gradually to 8 per cent., then to 11 per cent., and afterwards dropped to 5 per cent. From 1862 there were five dividends at 8 per cent., two dividends at 11 per cent., one dividend at 5 per cent., and another at 5½ per cent.

Mr. *John Lees Cocker*, examined by Serjeant SARGOOD.

I am one of the directors of the present company, and have been so for two years. I am an engineer, and the manager of the Merthyr Tydfil Gas-Works, and have been so for upwards of 18 years. I have been connected with large gas-works in London and Manchester, and have had considerable experience in the construction of gas-works. I am familiar with all the South Wales district. I was engineer to this company prior to being a director, and was advising them in 1872 as to the improvement of the works. Under my supervision the works were reconstructed. Some £4600 have been spent in improvements. I consider that the present manufacturing plant is quite inadequate to the present requirements. A new gasholder must be provided, and there must be some little addition to the mains, some of which have been down for about half a century. I consider that the works cannot be put in proper order at a less sum than £2000. The floating capital should not be less than £1000. With my knowledge of the present state of this company, and its utter inability to pay reasonable dividends, I think there are no possible means of raising capital except by this bill. For the last two years there has been no dividend paid. There is no ground for saying that our company have been buying coal from retail dealers. It might have occurred in case of extremity, but it is no index of the way in which we buy our coal generally. The consumption of 1600 tons a year is very small compared to what is used by London companies, but we have not the market in our hands that the London companies have, and we are in a coal district utterly unsuited to our wants. The amount paid for coal used during the last financial year was £1958 11s. 6d.; the amount received for residuals—namely, £494 18s. 5d.—being deducted, leaves a net sum of £1463 13s. 1d. The working expenses were £1033 1s. 10d., making £2496 14s. 11d. as the actual cost of the coal plus the manufacture, or 53·12d. per 1000 as the cost of the gas at the consumer's meter. The company have been working without a profit, not earning enough to pay interest on the borrowed money.

Mr. PHILBRICK: The interest is included in the expenses.

Witness: I believe our company would be willing, on fair and equitable terms, to hand over the works to the corporation if they desired it. I accept Sugg's burner as the recognized parliamentary burner, and am desirous of adopting it simply on that ground. I consider that the minimum pressure—7-10ths—provided by the bill is sufficient for that locality.

Cross-examined by Mr. PHILBRICK: My acquaintance with the company commenced in 1870. I know of nothing in the Act that would prevent Sugg's burner being used. The price of gas at Merthyr is 5s. to all consumers. It is, however, a much larger place than Carmarthen. The sale last year was about 26 million feet. The average price of coal during the last month at Merthyr was 23s. 10d. per ton. We do not use cannel because we find the coal we use produces the statutory illuminating power. We consider it more economical to work without any cannel at all. The per centage of coke used in carbonizing coal is nearly 40 per cent. for a six hours charge. We work the charges sufficiently to get out of it all that is worth getting practically. The make per ton is about 8700 feet from practically the same description of coal that is worked at Carmarthen. The difference is accounted for, perhaps, by the retorts at Carmarthen not being so good as ours. A retort requires repairing every two or three years. I do not endorse the statement that at Carmarthen they are using 50 per cent. of coke to carbonize their coal. That is not a large quantity in the opinion of some engineers, but I know some gas-works in which the per centage is not so large. In regard to the works at Carmarthen, I have every reason to believe that the exhauster is working properly. The average leakage or unaccounted-for gas in most companies is from 10 to 14 per cent.

Re-examined by Serjeant SARGOOD: The per centage of coke used in carbonizing would very much depend upon its heating property. I have not used the Bryndw coal, and therefore I cannot tell the amount of carbon it contains, or its heating properties. At Merthyr we pay a dividend of 10 per cent. upon the original capital, which is £11,000, 5 per cent. upon the preference stock, which is £3300, and 7 per cent. upon the remainder of the capital. The total amount of capital in round numbers is about £30,000. The works in Merthyr, and the consumption of gas, and everything connected with it, are on about three times as large a scale as those at Carmarthen. Carmarthen being a small consuming place, the company there cannot work so advantageously as they could in a town which is much larger.

Serjeant SARGOOD: Having regard to your locality, and the locality of Carmarthen in relation to the coal-fields, and having regard to the price you are getting—5s. per 1000—in your judgment do you consider that the 6s. we are asking as a maximum price is too much?

Witness: Not at all. I do not think it is at all unreasonable in any respect.

Serjeant SARGOOD: Do you gentlemen, who are on the board, give your best attention and intelligence to the carrying on of this business fairly and justly with a view to economizing as much as you can of the outlay?

Witness: We do. Our attention is turned to all questions of manufacturing; and as to the price of coal, I myself inquire as to the price of that, and we go to the cheapest market. I believe we have been buying our coal as advantageously as it can be bought.

Serjeant SARGOOD: Are you paid as directors?

Witness: Not one farthing; there is no charge whatever for directors fees.

WEDNESDAY, MARCH 10.

Mr. *G. W. Stevenson*, examined by Serjeant SARGOOD,

I have been in practice as a civil engineer for the past thirty years, and have given particular attention to gas matters. I have a general knowledge of Carmarthen and its gas interests for some years past. I have specially examined the works for the purposes of this bill. I have examined the accounts from 1870 to 1874 to see what the character and working of the results have been. At the present moment the expenditure of the company upon capital is £13,871. At the time of the incorporation in 1870 a good deal of expenditure was required, and was made immediately after the passing of the Act, in the improve-

ment of the works and so forth, to the extent of £4608. I know Mr. Cocker, the manager. I have generally inspected the mode of management, and I consider that the management was, and is, both economical and judicious. To carry on their works fairly and properly, the company would require to spend about £4000. They want additional storeage; their retorts ought to be taken down and reconstructed on a better principle, and the main-pipe requires to be replaced. Hearing, as I have done, that the mains have been down for about half a century, I have no doubt that the time has arrived when it is proper to relay them. I do not think they are in so bad a condition as that they are somewhat too small. A larger leading main ought to be laid from the works up to the town, and the mains that are displaced by larger mains should be carried forward. The unaccounted-for gas at the present is only 14 per cent. of all the gas made, and that shows that the main-pipe is in a tolerably good condition. Having regard to the character of the works at Carmarthen, and the capabilities and the nature of the supply, I do not consider that 14 per cent. unaccounted-for gas is excessive. It is larger than it ought to be, but it arises from the mains being too small, and the gas having to be delivered to the consumers at too high a pressure. For the remedying of that, the company require further capital, but they are doing the best they can under the present circumstances. The bulk of the gas unaccounted for is due to condensation. Illuminating gas is carburetted hydrogen, the natural tendency of which is to resolve itself into water. There is a difference in the measurement between the station-meter and the consumer's meter. The condensation would account for the greater portion of unaccounted-for gas. Then there is a difference between the assumed consumption of the public lamps and the actual consumption, as they usually burn somewhat more than is contracted for. Then there is the gas used in the works; that is not measured. Then there is absolute leakage in the joints of the pipes and from service-pipes. Although the 14 per cent. is above what I consider a proper average for the metropolis, I do not consider it is an unfair thing to find in Carmarthen; and, with the present condition of the works, I am surprised the unaccounted-for gas is so little; 5-10ths for the night and 7-10ths for the day is the pressure provided for by the bill, although 6-10ths and 8-10ths are the usual thing. I do not say that 5-10ths and 7-10ths would not be sufficient, but I see no reason for departing from the ordinary rule in that respect. If the consumers get a minimum of 5-10ths and 7-10ths, it is quite enough. It is a disadvantage for the consumer by meter to have a needless amount of pressure, because consumers, generally speaking, do not regulate the consumption of gas at the meter, but by a tap close at the point of ignition, and it is almost impossible to get a good result from the combustion of gas when the pressure is so regulated. It ought to be regulated at some distance from the point of ignition. Practically, the effect would be that a needless amount of pressure would drive a larger quantity of gas through the meter than they need for consumption, because the combustion of gas is imperfect at a high pressure; you get a blue flame instead of a white flame. The lower the pressure at the point of ignition, the higher the illuminating power of the gas. Provided the normal pressure is sufficient to give a proper amount of light, it is to the advantage of the consumer not to increase the pressure needlessly, but to diminish it to its lowest possible point. Having regard to the price of coal, and the present state of the company's capital, I do not consider it possible for them to raise further capital at the present moment without the assistance of Parliament. I think the company are too modest in asking for £10,000; I would have advised them to ask for more, because it is a very considerable burden upon a small company to go to Parliament and be opposed. There will be from £1000 to £1200 for parliamentary expenses, which will have to be added to the capital of this company, and the consumers will have to pay a dividend upon that in perpetuity. It will be totally unproductive to them of any good, and it must of necessity come out of the capital. With regard to a progressive increase of the company since 1870, I find from inspection of the accounts that the entire increase is at the rate of 9½ per cent. per annum. Last year the increase was 12 per cent. on the consumption of the year previous. I consider that indicates a wholesome state of management. If such a state of things continue, I consider the company would have to go to Parliament again in ten years. A big company may afford to go to Parliament very frequently, but it is very burdensome upon small companies. In order to get the capital raised, there must be an adequate inducement to investors in the shape of getting a dividend in return. It is not possible to carry on this company at the price they are charging at present for gas. In 1873 they made an absolute loss. The sum received for gas in that year was less than the sum actually paid for coal, without all the working expenses being added, which is an impossible state of things to go on with. The company are now paying nearly the same price for coal as they were paying in 1873. I do not think the cost of coal will ever again be what it was before the rise took place. It is utterly impossible that it can be. The rise we may date from 1871-1872. I am aware that the bill passed in 1870 was founded on the Neath Bill, which authorized the 4s. 2d. price. But having regard to the distinctions between the features of the Neath Company and the Carmarthen Company, the rise of 4d. ought to have been 6d. I consider that 6s. 8d. as a maximum would just pay the interest on borrowed capital, and the dividend on share capital.

Serjeant SARGOOD: Having regard to the fact that a portion of the capital will no doubt be raised by mortgages, do you consider that the 6s. which we ask is at all an unfair price?

Witness: No; it will not suffice. The company cannot possibly float their capital under the present circumstances, and they cannot carry on their business except by putting their hands year by year into their pockets. The 6s. is by no means an unfair price to ask in this bill. In the regulation of price during the last year or two, where the big undertakings have come before the referees, the system they proposed was to calculate the sum required to pay the statutory dividend, and add that to the price of the gas, so as to secure the companies in receipt of their maximum dividends. The present price cannot give the maximum dividend, even at the moderate use of the capital at the present moment, much less if they had to raise the whole of it by-and-by, or in the next ten years, although I hope by that time the business will be so extended as to give a larger amount of profit, and to lessen the price of gas. Then the Gas-Works Clauses Act will come into operation, and compel the reduction of the price.

Serjeant SARGOOD: Have you looked at the petition, and have you seen the suggestion that we ought to continue to supply gas at 4s., notwithstanding that it is notorious that the gas costs us more?

Witness: I have.

Serjeant SARGOOD: Is it not equally notorious that a great number of companies have come for an extension of their price founded upon the grievance that they are suffering from the impossibility of their making gas and selling it at the original price?

Witness: That is so; and I believe that every company that has come to Parliament has got relief. I do not know an instance where they have not. I have been in them all. The Aberdare Company in 1864 got an increase of a shilling; the Alliance, in Dublin, 1s. 4d.; the Neath, 1s. 4d.; the Brighton and Hove, an increase of 6d., and an alteration of the burner, which was said to be equivalent to 3d.; Burnley got an increase of 6d.; Glasgow was raised from 4s. 7d. to 6s.; Cork got 6d.; Paisley was raised from 4s. 2d. to 6s.; Southport got 3d.; Wrexham got 8d. All of them, more or less, according to the exigencies of their position, obtained an increase of price. When Llanelly applied for a new Act of incorporation they got 5s. 6d. in the borough and 7s. beyond. I can give the prices of gas in the places surrounding Carmarthen. Pontypool, with coal all round, and within three miles of the town, and with a consumption of 13 million feet, had in 1873 a maximum fixed at 5s. 6d., although the bill was strongly opposed. Pontypridd is now charging 5s. 6d.; their sale is 13½ million feet a year, and they have a colliery from which they get their coal within a mile and a half of their works. They are quite in the centre of the coal-fields. Ystradd, a place in the Rhondda Valley, where the very best gas coal in South Wales is obtained, has a sale of 10 million feet a year, with a population of 30,000, and the price is 6s. 8d. That price they got last year. Three of the large metropolitan companies—the Chartered, the Imperial, and the South Metropolitan—are entitled, under special machinery invented by Parliament, to get relief when they wish to raise their price. Some time in the month of January, the Board of Trade are bound to appoint commissioners to hear the statements of the company and the statements of their opponents, and, after consideration, they award them such a price for the current year as will secure them, with due care and management in the business, the receipt of their maximum dividends, and the bulk of those dividends is 10 per cent. In the case of one company the whole of the dividends is 10 per cent.

Serjeant SARGOOD: Was I right in stating to the committee the principle upon which the subject was submitted to them was this—that the coal, plus the working, and minus the residual products, was one item; that the necessary amount for the dividends was the second item; and that the two conjointly represent the price for the 1000 feet, which was necessary to discharge that obligation; and that that was the principle upon which the subject was discussed on all sides?

Witness: You have stated it exactly.

Serjeant SARGOOD: Looking at the working expenses developed by the accounts during the last four years, in your judgment do you think that they are at all unfair?

Witness: They are very reasonable indeed. The working expenses in the case of Carmarthen are less in proportion than those of several metropolitan companies. The expenses in a large concern are, as a matter of fact, smaller than those in a small concern. The working expenses at Carmarthen will compare very favourably even with very large companies.

Serjeant SARGOOD: I suppose it is somewhat absurd to imagine that we are to lose sight of the fact, as the petition seems to do, that a commercial company is established for profit?

Witness: I do not think that the petitioners would be content to work for nothing. An authorized gas company that works without profit will be simply trustees for the consumers of gas. When I went to make my inspection I found the works indicative of due care and management. The additions to the works by Mr. Cocker have been extremely well designed, and the works well carried out. They only need to go on in the same direction, and to do that they must have more money.

Serjeant SARGOOD: Having regard to the financial exigencies of the company at this moment, do you think it an unfair thing that we should limit them to the exercise of the right of saying whether or not they will consent to the Town Council buying them up until after a period of three years?

Witness: Yes; I think it fair the company should have time to get their house in order, and to show there will be a value in the undertaking, which in three years I am sure there will be.

Serjeant SARGOOD: Of course I need scarcely ask you to take the thing by arbitration, as valued by the profits of the last three years, one of which has been a loss, and in two of which there has been a minimum profit, which has not been worth working for; it would be an insult to common sense to suppose so.

Witness: It would be. There is no value beyond the bricks and the mortar, and so on. The corporation have power, by the Gas-Works Clauses Acts of 1871, to appoint an examiner to inquire into the illuminating power, purity, and quality of the gas. I consider it is desirable to regulate the illuminating power, which is now 14 candles with the Sugg burner. I do not say that it is the one that is authorized by Parliament, but it has been adopted within the last two or three sessions. It is the burner sanctioned by the Board of Trade, in all orders, and is so far recognized by Parliament.

Cross-examined by Mr. LITTLER: It is a fact, is it not, that in all other districts of South Wales coal has been going down for some time?

Witness: Yes; I am getting coal from Durham to Tenby, in South Wales.

Mr. LITTLER: You do not anticipate, when this unhappy strike is over, that coal will be the same as it is now?

Witness: I do not know what it will be; I hope not. You cannot compare South Wales with Durham or the Midland district; the output in Durham and the Midland district is so enormous as compared with South Wales, that it will not bear any comparison, and the bulk of the coal in South Wales is anthracite. The bituminous coal is small in proportion, and it always will have its price. In South Wales, in 1870, coals were 8s. 2d. per ton. Durham coal I was buying at that time in thousands of tons for 6s. That is not a fair proportional difference. I do not think it will ever be so low again, although I hope it may be. I am paying 10s. free on board for Durham coal, as against 26s. in South Wales, which includes freight. The freight to Carmarthen from Bryndw I do not know. It would not be anything like the difference between 10s. and 26s. The works at Carmarthen, so far as they go, are very good indeed, except the retorts. Extra storeage is wanted, the cost of which I would put down at £1200. The gasholder would be 50 feet in diameter, and 16 feet deep. I do not attribute the increase of gas to the increase of population. It is a fact that where gas is supplied of good quality, and tolerably pure, and where no serious complaints are made, the consumption goes on increasing at a certain ratio in towns where the population is entirely stagnant; gas comes into more general use, and people who use it use it more freely. The population of Carmarthen is very nearly stationary. The increase to the annual income of the company by raising the price of gas to 6s. I estimate at £845. The increase, no doubt, to some extent will be to retard the increase of gas to some extent, perhaps more than a year; but after a short time people become accustomed to pay the higher price.

Mr. LITTLER: Until at last they like it?

Witness: I do not mean to say that, but we have got the experience of London that this is the case. The price was put up to 6s. 3d. in the western district, and the consumption of The Gas Company increased. In the year the price was raised, the consumption increased 1½ per cent., instead of the normal increase of 9 per cent., but they made up for the loss afterwards.

Mr. LITTLER: If this company's Act of Parliament remains as it is, if they do not get the relief they seek, or something like it, their works or undertaking, for the purposes of sale by arbitration, or otherwise, are valueless except as old material. Do you mean to tell the committee that at the 4s. 6d. rate you would not advise the company, though they had the power, to ask something from Parliament as a going concern?

Witness: I should advise them to hold the works on, and come again another year.

Mr. LITTLER: Do you think it is so desperate a case that, if they had no further powers granted them, you would advise them that the best thing to do would be to shut up their works.

Witness: They cannot shut up their works; they are under a statutory obligation to supply gas.

Mr. LITTLER: Would you advise them that that was the best thing to do for themselves.

Witness: I would not indeed. I cannot tell how soon coal may so come down in price as to enable the company to pay a dividend; and, until they pay a dividend, their works are worthless for the purposes of sale. I would not give them £5000 for all they have invested in these works if the statutory powers are to remain as they are. The proper quantity of gas to be produced from the ton

of coal is from 8000 to 8500 feet. I cannot get that at Tenby, but I must do the best I can for myself. Coal can be obtained much more easily at Newport than at Carmarthen, because the railway brings it close to the town, and Newport is a shipping place for coal. I give 26s. for coal at Tenby. The maximum price for the gas at Tenby is 5s. 6d., and I am losing money by selling it at that price. The works are held under a lease from the corporation. The make is 6,000,000 feet in the year. The less I sell at the price the better. Those are coals I get round from Newcastle. Welsh coal costs me about 24s.

Mr. LITTLER: If the price of gas is increased, what is the per centage in the increase of consumption you anticipate at the end of three years?

Witness: Assuming the company get a 6s. price, I think probably the consumption would be quite stationary, or nearly so, for the next year. Then it would begin to grow again, and probably increase 5 or 6 per cent., and in the following year would get up to what it was before—the normal increase of 9 per cent. or more, but really the opinion is not worth anything.

Re-examined by Serjeant SARGOOD: With regard to the raising of the price depreciating the amount of consumption, that is almost a natural consequence in any commodity of trade—the sudden raising of the price checks the consumption?

Witness: It is so.

Serjeant SARGOOD: Whether people get reconciled to pay the price or not, is not gas, even at the raised price, the cheapest sort of light of which people can avail themselves for ordinary purposes?

Witness: It is so.

Serjeant SARGOOD: And, therefore, in the end, gas is cheaper than any other light?

Witness: At 10s. per 1000, it would be cheaper than any other light.

By the COMMITTEE: I do not know any place where the pressure is so low, as is to be authorized in this bill—6-10ths and 8-10ths is the usual pressure.

Serjeant SARGOOD said, with the permission of the chairman, his clients were quite willing to insert in the bill 6-10ths and 8-10ths, instead of 5-10ths and 7-10ths of pressure, which alteration would be in accordance with the provisions of the model gas bill.

Mr. *Henry Bowen*, examined by Mr. MICHAEL, said he was the resident manager of the Cardiff Gas-Works. The make of gas in his company was 180 million feet per annum. In 1870 coal was 13s. 6d., and he thought that 4s. 6d. at that time would allow for the paying of the statutory dividend. The price at Cardiff was 4s. in the town, and 5s. in the outlying districts. The cost of coal at present for one portion was 20s., and 16s. for another portion, which was supplied by contract. He had examined the books of the Carmarthen Company. The cost of gas was 4s. 5d. at the consumer's meter; 2s. 7d. being the cost of the coal, and 1s. 10d. being the working charges. He believed that under the existing circumstances that was the lowest price at which it could be produced at Carmarthen. He thought the works were in good order, and fairly managed, and he did not think the quantity of coke used was excessive. Materials and labour had increased in the district since the year 1870, all of which would tend to influence the price of gas. He thought the price asked for by the bill was reasonable.

Cross-examined by Mr. LITTLER: The actual charge for gas at Cardiff was 3s. 9d. and 4s. 3d. The coal was carried for eleven miles beyond Cardiff.

Mr. *Thornton Andrews*, examined by Mr. MICHAEL, said he was the engineer and manager of the Swansea Gas Company. The sale of gas in the Swansea Company was 130 million feet, and the make was 145 million feet. The per centage of unaccounted-for gas was 11 per cent. He did not think that the per centage of unaccounted-for gas in the Carmarthen Company was excessive. It might be diminished by the improvements that were contemplated in the mains. He visited the Carmarthen works on the 2nd of January last, and found them in excellent condition. He had examined the capacity of the works, which were suitable for a largely increased supply. The working expenses were reasonable and fair for the quantity of gas manufactured. He did not give any intimation of his intention to visit the works. The Bryndw coal was the best description of coal raised in South Wales. The Swansea Company were paying, under contract, 16s.; but only a portion of coal, not sufficient for the requirements of the works, could be obtained for that price. They paid 24s. 6d. for Newcastle coal, of which they had had several cargoes lately. They also got the small overplus which companies in the district could not sell. Although they were in the centre of the coal-fields there was great difficulty in obtaining coal. The Neath and Llanelly Gas Companies got the price raised to 5s. 6d., and last year the Neath 5s. 6d. was made perpetual, and the restriction for twelve years was taken off. Llanelly obtained 6s. and 7s. without the borough, without any restriction. Llanelly is nearer the supply of coal than Carmarthen. It is an associated borough with Carmarthen. The consumption of Llanelly is 21 million or 22 million feet per annum. Taking the price of gas at 4s. 5d. at the consumer's meter, and adding to it the amount of the dividend on expended capital, the selling price of the gas ought to be 6s. 7d. or 6s. 8d. He thought 6s., as asked by the bill, a reasonable price under such circumstances. He believed that the present strike—the end of which could not be seen at the present moment—would, no doubt, raise the price of coal during the next twelve months. He did not think the amount of capital asked was excessive. £4000 for a margin, after paying for the various works in progress, was not sufficient. When the Swansea Company came to Parliament in 1861, their capital was £9000, consisting of £6000 of share capital and £3000 debenture. The outlay which had been made out of profit from year to year previously raised the total to £21,000, and they obtained power to raise another £100,000 share capital, with £25,000 borrowing powers. The present capital expended was £74,500 with a portion of borrowed money, so that in reality 250 per cent. had been added to the capital of 1861. Supposing the Carmarthen Company to go increasing in the same ratio, it would be necessary to expend money on the works to meet the increased supply.

Cross-examined by Mr. PHILBRICK, witness said that Swansea had increased very fast during those 14 years. It had become very thickly populated, but the population was not of that class requiring gas. He expected a permanent rise in coal at the end of 12 months. He did not think that coal would ever go down to the original price of 1871-2; besides, the price of labour had been permanently raised. He considered the works at Carmarthen were very well constructed, and the alterations made were very judicious.

Mr. PHILBRICK: So that as regards requirements, in a short time they ought to be able to make their gas as cheaply as anybody.

Witness: In proportion to the size of the works.

Mr. PHILBRICK: With regard to the working charges, is it your opinion that they would be permanently 1s. 10d., and that no improvement could reduce that sum?

Witness: I do not think that you can show me any item that is an excess of expenditure in the accounts.

Mr. PHILBRICK: So that the 2s. 6d.—the price of the coal—is the item that would regulate the price?

Witness: The increase in price within the last two years is exceptional.

This concluded the case for the promoters.

Mr. LITTLER said he would call his witnesses first, and address the committee afterwards.

Mr. *D. Lewis*, examined by Mr. PHILBRICK, said he was a member of the Town Council of Carmarthen, and had been for some years, and was mayor last year. He had taken no interest in the gas question until recently, when the notices for the bill were issued. The subject of the bill was brought before the corporation after the notices appeared. A meeting was held (said the witness) in December, to consider the gas question, and I took part in the discussion. I do not think the council at that time intended opposing the bill, as they understood the consumers, who would be more affected than the council by it, were opposing it. At the last stage the Town Council passed a resolution condemning the bill. The price was one of the great matters objected to. I myself proposed the resolution, and was one of the deputation that conveyed that resolution to the directors of the gas company. We felt aggrieved that the company was losing money on our account, but there was an agreement with them to light the streets, and we wanted to have them lighted as cheaply as possible. The Town Council unanimously passed a resolution at a meeting in February in favour of buying the works from the company. The names to the petition represent the bulk of the large consumers.

Cross-examined by Mr. MICHAEL, witness admitted that at the meeting he said there had been too much time spent upon discussions on gas and light, and that more attention should be given to sanitary matters.

Mr. *W. J. Morgan*, proprietor of the *Welshman* newspaper, said he took part in the opposition of 1868 and 1869. He was one of the committee. A bill was deposited and communcations passed between the solicitor to the proposed company and the solicitor of the old Carmarthen Gas Company, and heads of an agreement for a compromise were agreed to. At that time 4s. 6d. was consented to, but he thought that was too high a price. The consumers—especially the large consumers—had a very great objection to the bill. There was no difficulty in getting the necessary funds raised for the purpose of opposing the bill. He had gone through the list of petitioners, which contained the names of some of the largest consumers. There were only two large consumers whose names were not in the list. In February he believed the capital for the purchase of the gas-works could have easily been raised, as public opinion was in favour of the purchasing of the gas-works.

Cross-examined by Serjeant SARGOOD: Witness was not aware of how the public meeting, preceding the public meeting convened by the mayor, was called. He did not think there was any allusion to the meeting in the *Welshman* until after it was held. The first meeting in reference to the gas question was reported in the *Welshman* of Dec. 18. That meeting was summoned by each one telling his neighbour. The next meeting proposed a committee to inquire into the matter, and the committee afterwards held a private meeting. There were several meetings held at the *Welshman* office before the requisition to call a meeting was handed to the mayor. He attended the meeting convened by the mayor. There were three resolutions passed—first, that it was desirous that the corporation should take over the gas-works; secondly, if the corporation decided to buy, that the company be requested to withdraw the bill; and thirdly, that if the company refused to sell, or to withdraw the bill, that the meeting pledge itself to oppose it. The resolutions were next handed to the council, who afterwards passed a resolution in accordance with the first resolution passed at the meeting. They did not pass any further resolutions so far as he was aware. From that time to this, so far as he was aware, the council were quiescent in the matter. He thought he paid for gas at the office about £10 or £12, and about £5 privately. His private interests as a consumer were not his motives for opposing the bill. He did not think he examined the accounts before the petition was lodged. He could not remember where he signed the petition.

Serjeant SARGOOD: Having heard here in evidence that the company supplied this £12 of gas to your office and £5 of gas to your private house at an absolute loss, do you still, without a blush, contend that it would be unjust to the consumers if the company were obliged to charge a higher price than 4s. 6d.—that is your opinion?

Witness: Yes; most decidedly.

Serjeant SARGOOD: Then you are such a reasonable man that I shall not ask anything more of you.

Re-examined: The reason why he thought the price should not be increased was, that he heard some one say in Carmarthen that the company were a set of plunderers and blunderers. As far as he knew, there were no circumstances in Carmarthen that would prevent gas being supplied at 4s. 6d.

Mr. *A. Silverthorne*, examined by Mr. PHILBRICK, said he was a gas engineer in practice at Westminster Chambers. He had inspected the works at the request of the petitioners, and had made himself acquainted with their capacity, extent, and mode of working. They were, he thought, well adapted and laid out for the present demands, and for any future extension which might be likely to be required. They were only deficient in one respect—namely, storeage. The deficient storeage might be supplied at an expenditure of £600 or £800, and £1000 would cover all the extension that was needed. If the Bryndw coal was worked to a higher pitch than it was, no doubt the illuminating power would be less. He thought the sale of 7159 feet was excessively low in proportion to the make of 8400. He thought 9000 was what should be made, which could, no doubt, be done, if proper attention was given to the heating, and the retorts were set more judiciously than they were at present. He had heard that 9000 were made in neighbouring works with the same coal. He considered 41 per cent. of coke used much too high. Thirty-three per cent. was what was usually reckoned, especially in works of that capacity. He saw no reason why the company should not continue to use the Bryndw coal if judiciously worked. He assumed that the average price of coal that might be reckoned on in the present year was 21s. 6d. Such a local matter as the lock-out should not be taken into consideration when estimating the price of coal, as it might happen one day and be finished another. He thought that the result of having little or no dividend for the past few years was due to the coal crisis, but that would not apply to the future.

Cross-examined by Serjeant SARGOOD: Witness said he was in the room when Mr. Stevenson was examined. He (witness) was 28 years of age. He had not constructed any gas-works, but he had had the management of the manufacture of gas for companies in continental towns, who used English coal. He was engineer to several large towns in France, as important as Carmarthen. He had had no experience in the manufacture of gas, or as a manager of gas-works, in England, Ireland, Scotland, or Wales.

Serjeant SARGOOD: What do you intend to do with the £1000?

Witness: I intend to lay it out in a new holder, and in overhauling the service-pipes. The capacity of the gasholder I propose is 25,000 feet.

Serjeant SARGOOD: In your judgment, will that be sufficient for an establishment of this sort for the next ten years?

Witness: There is already 36,000 cubic feet of storeage at Carmarthen, and there should be another 25,000 feet; that would equal three-fourths of the greatest maximum consumption in the shortest day in winter.

Serjeant SARGOOD: How many years would elapse before we should have to put up another holder?

Witness: I cannot say positively, but it would meet the requirements of four or five years hence. Of the £1000 I would allow £800 for a holder. The other 200 might be applied to overhauling the service-pipes. I include a tank in the £800. I think £1000 is quite ample for all that is required. Although mains have been in the ground for 50 years, I do not think their age is the cause of the leakage. There is only 14 per cent. of leakage, by the showing of your own witnesses. Every company makes provision now and then for the repairing of the mains. I have never seen on paper any schedule of the mains, showing their respective sizes and capacities in relation to the work they had to do. It was the very first thing I applied for when I made the inspection. The information, however, was withheld, and, in the absence of that information, I am not able to form any opinion. In arriving at the price which I would charge to cover all expenses, I have included the debt and the amount of capital that has actually been expended. I worked my works, and did not require floating capital. I really never heard of a company the size of the Car-

marthen Company requiring £1000 for floating capital. We make out our bills on the Continent monthly, and pay our accounts every quarter.

Serjeant SARGOOD: That makes a slight difference.

Witness: I never made a single contract for either coals, or retorts, or materials, without having at least three months credit. I would never deal with any one that would propose other terms. I have never used the same coal as is used at Carmarthen. I use northern coals, or French coals. I am speaking only from what I know takes place at Neath. It is within my knowledge that at Neath they make 9000 feet out of Bryndw coals, and 9800 out of Rhondda coals. I had the fact communicated to me in writing.

Serjeant SARGOOD said that that was not evidence, because the statement might not be true even if in writing; and that the witness ought to speak from personal experience.

Witness (continuing) said he did not remember if he had actually made the statement in his examination-in-chief that the coal crisis was past. He might have said so inadvertently.

Re-examined: Witness said he appeared last year with Mr. Livesey as a witness on behalf of the Corporation of London at the inquiry before the Board of Trade Revision Commissioners. Most of the coal used by him in France was English coal, and there was not much difference between the quality of the gas and that manufactured in Carmarthen. He had had the management of the works in France for three years, and had had 12 years experience connected with gas and gas legislation.

This concluded the evidence for the petitioners.

Mr. LITTLER, in addressing the committee on behalf of the consumers, said that the evidence by which it had been attempted to support the application for the bill was the most meagre that in his experience had ever been presented to the House. The idea of getting additional capital, it was quite plain, was an afterthought, arising from the fact that they were to apply to Parliament on the question of price, because the report for the last half year stated that the company would be unable to declare a dividend while the price remained as it was. What did they want the increase of capital for? They had £6000 of unissued capital, and if they had issued it what position would they have been in? Their capital account showed an expenditure up to June 30, 1874, of £13,871. How could they have met that? The original capital of £8000, with £2000 borrowing powers, together with the £6000 unissued capital, and £1500 borrowing powers, would have made a total of £17,500, which, if the capital was available, would leave at the present moment a surplus of about £3500. It was not a usual thing under such circumstances for a company to apply for additional capital powers. The directors in their last report had stated that the reconstruction of their works was complete, and that the works were in full and satisfactory operation; therefore it was not a case of a company coming to Parliament, and saying, "We want to reconstruct our works, and we want additional capital." The only thing, as far as he could see, for which the company required additional capital was for additional storeage. As to the mains, some of them had been relaid since 1870. It was alleged that having been so long down they must be worn out; but the test showed that the actual leakage was only 14 per cent.; and where pipes were worn out the leakage was usually 30 or 40 per cent. That showed that no capital was required for the purpose of relaying the mains; and it had never been alleged in any of the reports that there was any necessity for it. It had been said that the normal increase in the consumption of gas was 9 per cent.; but that average included increase of population, and Carmarthen was a stationary place. He thought the company desired, in this instance, to increase their capital because they had a good customer, in the shape of the Town Council, looming in the distance. It was only an ingenious way of raising the purchase price, and he contended that the promoters had not submitted the smallest evidence that they wanted new capital. Having regard to the condition of their works, they did not require for some years any increase of capital, and the petitioners wanted the committee to say that, inasmuch as there was £6000 unissued, with £1500 borrowing powers attached, the margin was quite sufficient for a company well equipped, in good order, and able to go on. Since 1870, £3000 had been expended; and, having regard to the state of Carmarthen, the £3500 which was left was certainly as much as the company could by any possibility require for the next ten years. As to the question of price, he contended that the company had not made out a case for that. During the general famine, no doubt companies did go to Parliament, who were induced to give them relief to a greater or less extent; but here was a company asking for an increase in an abnormal state of things. They said that there is a coal strike in South Wales, and then Mr. Stevenson said he could not predict when the price of coals would come down.

Serjeant SARGOOD: I never opened the strike, and we gave no evidence in it.

Mr. LITTLER: No; but you are basing your claim for increase of price on the price now paid in Carmarthen, and that is a lock-out price. Everybody knew that when the strike was over the coals would come down very rapidly. If the company obtained an increased capital and an increased price, the two strongest incentives to strict economy and satisfactory working would be taken away. No doubt at the present price of 26s. the company could not make money; but that price might go at any time, and Mr. Silverthorne had said that in his opinion the price during the twelve months would not probably exceed 21s., and that with the exercise of due economy on the part of the company, 4s. 6d. was sufficient to give a proper dividend. The company wanted an increase of capital because they had an increased consumption; but they were going also to ask for an increased price, which, according to their own witnesses would bring down the per centage of the increase of business in three years from 27 to 14 per cent. Another thing worthy of remark was that the shares, as far as he could see, were still in the hands of the old holders, who had actually, according to recent figures, not only received sometimes interest varying from 8 to 11 per cent., but had been actually receiving £8 15s. for the last 40 years. Under these circumstances they must not complain if they have had three or four bad years, especially when they had restricted their work, and when they considered the abnormal state of the coal and labour market. They had charged the maximum conceded to them in 1870, and they were asking the committee now to vary that legislation by which they prevented another company from opposing the bill. They ought to make out an exceedingly strong case before they asked Parliament to vary that legislation. Seeing the advantages that they had had, they ought to be content to wait, and not come, during an extraordinary season, asking for a higher price. He asked the committee, representing, as he did unquestionably, the largest consumers of gas in Carmarthen, and the feeling, as far as could be ascertained, of the whole town, whether or not, in the face of such a strong opposition, and on the strength of so weak a case as had been presented by the promoters of the bill, grant them powers, or whether they would say, "Wait another year, and there may be some chance of saying then whether there is a probability of your being entitled to what you ask," especially considering that the throwing out of this bill would be the means of some one coming next year for a proper arrangement between the company and the corporation for the purchase of the works. Mr. Stevenson had said he would not advise the company to sell off their brickwork and materials. That only showed how very sanguine even an experienced gentleman like Mr. Stevenson might become when he looked at everything through the spectacles of his client. Looking to all surrounding circumstances, and considering that it had been a prosperous company for fifty years, no doubt if Mr. Stevenson were to discuss the matter on one side, and Mr. Silverthorne on the other, they would arrive at a reasonable price, and there would no doubt be an arrangement come to by next year. The powers sought by the promoters being founded upon such abnormal and exceptional circumstances, and being, to say the least of it, premature, he hoped the committee would refuse to sanction their request.

Serjeant SARGOOD said that as the matters referred to by his learned friend were more questions to be considered with the clauses, he had no desire to discuss the matter twice over, and that he should now simply ask the committee whether, in their opinion, the preamble of the bill had been proved.

The room was then cleared for the decission of the committee. On the public being readmitted,

The CHAIRMAN intimated that the committee were of opinion that the preamble had been proved.

Mr. LITTLER: Does that mean the increase of the capital and the increase in price?

Serjeant SARGOOD: You have no right to ask that question. The preamble of the bill, as you have been told, has been proved.

The CHAIRMAN (to Mr. Littler): We propose to leave it as it is.

The committee then proceeded to consider the clauses which were unopposed.

PUBLIC HEALTH BILL.

POWERS OF LOCAL AUTHORITIES IN RELATION TO THE SUPPLY OF WATER AND GAS.

The bill just presented to Parliament by the Local Government Board, for consolidating and amending the Acts relating to public health in England, contains the following provisions in relation to the supply of water and gas by local authorities.

WATER SUPPLY.

Powers of Local Authority in Relation to Supply of Water.

General Powers for Supplying District with Water.

50. Any urban authority may provide their district, or any part thereof, and any rural authority may provide their district, or any contributory place therein, with a supply of water proper and sufficient for public and private purposes, and for those purposes or any of them may—

(1.) Construct and maintain water-works, dig wells, and do any other necessary acts.

(2.) Take on lease or hire any water-works, and purchase any water-works, or any water or right to take or convey water, either within or without their district, and any rights, powers, and privileges of any water company.

(3.) Contract with any person for a supply of water.

Restriction on Construction of Water-Works by Local Authority.

51. Before commencing to construct water-works within the limits of supply of any water company empowered by Act of Parliament, or any order confirmed by Parliament to supply water, the local authority shall give written notice to every water company within whose limits of supply the local authority are desirous of supplying water, stating the purposes for which, and, as far as may be practicable, the extent to which water is required by the local authority.

It shall not be lawful for the local authority to construct any water-works within such limits, if and so long as any such company are able and willing to supply water proper and sufficient for all reasonable purposes for which it is required by the said authority; and any difference as to whether the water which any such company is able and willing to lay on is proper and sufficient for the purposes for which it is required, or whether the purposes for which it is required are reasonable, or as to the terms of supply, shall be settled by arbitration in manner provided by this Act.

Power of Carrying Mains.

52. Where a local authority supply water within their district, they shall have the same powers for carrying water-mains within or without their district as they have for carrying sewers within or without their district respectively by the law for the time being in force.

Incorporation of Provisions of Water-Works Clauses Acts.

53. For the purpose of enabling any local authority to supply water, there shall be incorporated with this Act the Water-Works Clauses Act, 1863, and the following provisions of the Water-Works Clauses Act, 1847, namely:—

With respect to the supply of water to be furnished by the undertakers; and

With respect to the communication-pipes to be laid by the undertakers; and

With respect to the communication-pipes to be laid by the inhabitants; and

With respect to waste or misuse of the water supplied by the undertakers; and

With respect to the provision for guarding against fouling the water of the undertakers; and

With respect to the payment and recovery of the water-rates.

Provided that the provisions with respect to the supply of water to be furnished by the undertakers, and with respect to the communication-pipes to be laid by the undertakers and the inhabitants respectively, shall apply only in districts or parts of districts where the local authority lay any pipes for the supply of any of the inhabitants thereof; and

That the water to be supplied by the local authority need not be constantly laid on under pressure; and

That section 44 of the Water-Works Clauses Act, 1847, shall for the purposes of this Act have effect as if the words "with the consent in writing of the owner or reputed owner of any such house, or of the agent of such owner," were omitted therefrom; and any rent for pipes and works paid by an occupier under that section may be deducted by him from any rent from time to time due from him to such owner.

Register of Meter to be Evidence.

54. Where water is supplied by measure by any local authority, the register of the meter, or other instrument for measuring water, shall be evidence of the quantity of water consumed; and if the local authority and the consumer differ with respect to the quantity consumed, the difference shall be determined, on the application of either party, by a court of summary jurisdiction, and such court may order by which of the parties the costs of the proceedings before them shall be paid, and its decision shall be final and binding.

Penalty for Injuring Meters.

55. If any person wilfully, or by culpable negligence, injures or suffers to be injured any meter or fittings belonging to a local authority, or fraudulently alters the index to any meter, or prevents any meter from duly registering the quantity of water supplied, or fraudulently abstracts or uses water of the local authority, he shall (without prejudice to any other right or remedy of the local authority) be liable to a penalty not exceeding 40s., and the local authority may in addition thereto recover the amount of any damage sustained. The existence of artificial means, under the control of the consumer, for causing any such alteration, prevention, abstraction, or use, shall be evidence that the consumer has fraudulently effected the same.

Power to Supply Water to Authority of Adjoining District.

56. Any local authority for the time being supplying water within their own district may, with the sanction of the Local Government Board, supply water to the local authority of any adjoining district on such terms as may be agreed on between such authorities, or as, in case of dispute, may be settled by arbitration in manner provided by this Act.

Local Authority may Require Houses to be Supplied with Water in Certain Cases.

57. Where on the report of the surveyor of a local authority it appears to such authority that any house within their district is without a proper supply of water, and that such a supply of water can be furnished thereto at a rate not

exceeding 2d. a week, or such other rate as the Local Government Board may, on the application of the local authority, determine under all the circumstances of the case to be reasonable, the local authority shall give notice in writing to the owner, requiring him, within a time therein specified, to obtain such supply, and to do all such works as may be necessary for that purpose.

If such notice is not complied with within the time specified, the local authority may, if they think fit, do such works and obtain such supply, and may make and levy water-rates on the premises as if the owner or occupier of the premises had demanded a supply of water, and were willing to pay water-rates for the same, and the expenses incurred by the local authority in doing such works may be recovered in a summary manner from the owner of the premises, or may, by order of the local authority, be declared to be private improvement expenses.

Directors of Water Company may sell Works, &c., to Local Authority.

58. Any water company may contract to supply water, or may lease their water-works to any local authority; and the directors of any water company, by and with the authority of three-fifths of the shareholders in such company who may be present, either personally or by proxy, at some general meeting of the company specially convened for the purpose, may sell and transfer to any local authority, on such terms as may be agreed on between the company and the local authority, all the rights, powers, and privileges, and all or any of the water-works and other property of the company, subject to all mortgages, contracts, or liabilities to which the same are subject at the time of such purchase.

Vesting of Public Cisterns, &c., in Local Authority.

59. All existing public cisterns, pumps, wells, reservoirs, conduits, aqueducts, and works used for the gratuitous supply of water to the inhabitants of the district of any local authority shall vest in and be under the control of such authority, and such authority may cause the same to be maintained and plentifully supplied with pure and wholesome water, or may substitute, maintain, and plentifully supply with pure and wholesome water other such works equally convenient; or they may (subject to the provisions of this Act) construct any other such works for supplying water for the gratuitous use of any inhabitants who choose to carry the same away, not for sale, but for their own private use.

Water for Public Baths, or Trading or Manufacturing Purposes.

60. Any local authority may, if they think fit, supply water from any water-works purchased or constructed by them under this Act to any public baths or washhouses, or for trading or manufacturing purposes, on such terms and conditions as may be agreed on between the local authority and the persons desirous of being so supplied; moreover, any local authority may, if they think fit, construct any works for the gratuitous supply of any public baths or washhouses established otherwise than for private profit or supported out of any poor or borough rates.

Agreements with Universities.

61. In the Oxford or Cambridge district the local authority may supply water to any hall, college, or premises of the university within such district, on such terms with respect to the mode of paying for such supply as may from time to time be agreed on between such university, or any hall or college thereof, and the local authority.

Provisions for Protection of Water.

Penalty for causing Water to be Corrupted by Gas Washings.

62. Any person engaged in the manufacture of gas who—

(1.) Causes or suffers to be brought or to flow into any stream, reservoir, aqueduct, pond, or place for water, or into any drain communicating therewith, any washing or other substance produced in making or supplying gas; or

(2.) Wilfully does any act connected with the making or supplying of gas whereby the water in any such stream, reservoir, aqueduct, pond, or place for water is fouled, shall forfeit for every such offence the sum of £200, and where the water belongs to or is under the control of the local authority, after the expiration of 24 hours notice from them in that behalf, a further sum of £20 for every day during which the offence is continued or during the continuance of the act whereby the water is fouled.

Every such penalty may be recovered, with full costs of suit, in any of the superior courts, in the case of water belonging to or under the control of the local authority by the local authority, and in any other case by the person into whose water such washing or other substance is conveyed or flows, or whose water is fouled by any such act as aforesaid, or in default of proceedings by such person, after notice to him from the local authority of their intention to proceed for such penalty, by the local authority; but such penalty shall not be recoverable unless it be sued for during the continuance of the offence, or within six months after it has ceased.

Local Authority may take Proceedings to prevent Pollution of Streams.

63. Any local authority, with the sanction of the Attorney-General, may, either in their own name or in the name of any other person, with the consent of such person, take such proceedings by indictment, bill in Chancery, action, or otherwise, as they may deem advisable for the purpose of protecting any watercourse within their jurisdiction from pollutions arising from sewage either within or without their district; and the costs of and incidental to any such proceedings, including any costs that may be awarded to the defendant, shall be deemed to be expenses properly incurred by such authority in the execution of this Act.

Power to Close Polluted Wells, &c.

64. On the representation of any person to any local authority that within their district the water in any well, tank, or cistern, public or private, or supplied from any public pump, and used or likely to be used for domestic purposes, is so polluted as to be injurious to health, such authority may apply to a court of summary jurisdiction for an order to remedy the same; and thereupon such court shall summon the occupier of the premises to which the well, tank, or cistern belongs, if it be private, and in the case of a public well, tank, cistern, or pump, any person alleged in the application to be interested in the same, and may either dismiss the application, or may make an order directing the well, tank, cistern, or pump to be permanently or temporarily closed, or the water to be used for certain purposes only, or such other order as may appear to them to be requisite to prevent injury to the health of persons drinking the water.

The court may, if they see fit, cause the water complained of to be analyzed at the cost of the local authority applying to them under this section.

The expenses incurred by any rural authority in the execution of this section shall be special expenses.

LIGHTING STREETS, &c.

Powers of Urban Authority for Lighting their District.

154. Any urban authority may contract with any person for the supply of gas, or other means of lighting the streets, markets, and public buildings in their district, and may provide such lamps, lamp-posts, and other materials and apparatus as they may think necessary for lighting the same.

Where there is not any company or person authorized by or in pursuance of Act of Parliament, or any order confirmed by Parliament, to supply gas for public and private purposes, supplying gas within any part of the district of any urban authority, such authority may themselves undertake to supply gas for such purposes or any of them throughout the whole or any part of their district; and if there is any such company or person so supplying gas, but the limits of supply of such company or person do not coincide with the boundaries of the district, then the urban authority may themselves undertake to supply gas throughout any part of the district not included within such limits of supply.

Where an urban authority may under this Act themselves undertake to supply gas for the whole or any part of their district, a Provisional Order authorizing a gas undertaking may be obtained by such authority under the provisions of the Gas and Water Works Facilities Act, 1870; and in the construction of the said Act, the term "the undertakers" shall be deemed to include any such urban authority: provided that for the purposes of this Act the Local Government Board shall throughout the said Act be deemed to be substituted for the Board of Trade.

Power for Sale of Undertaking of Gas Company to Local Authority.

155. Any urban authority may buy, and the directors of any gas company, by and with the authority of three-fifths of shareholders for the time being of such company who may be present either personally or by proxy at some general meeting of the company specially convened for the purpose, may sell and transfer to such authority, on such terms as may be agreed on between such authority and the company, all the rights, powers, and privileges, and all or any of the lands, premises, works, and other property of the company, but subject to all liabilities attached to the same at the time of such purchase.

Watching & Lighting Act (3 & 4 Wm. IV., c. 90.) to be superseded by this Act.

156. Where in any place which after the passing of this Act becomes constituted or included in an urban district, or which by virtue of any order of the Local Government Board becomes subject to this enactment, the Act passed in the fourth year of the reign of King William the Fourth, intituled "An Act to repeal an Act of the eleventh year of His late Majesty King George the Fourth, for the lighting and watching of parishes in England and Wales, and to make other provisions in lieu thereof," has been adopted, the said Act shall be superseded by this Act, and all lamps, lamp-posts, gas-pipes, fire-engines, hose, and other property vested in the inspectors for the time being under the said Act shall vest in the authority having under this Act jurisdiction in such place.

Legal Intelligence.

COURT OF CHANCERY.—FRIDAY, MARCH 12.

(*Before Vice-Chancellor* HALL.)

Re COAL ECONOMIZING GAS COMPANY.

This was a petition for a winding-up order.

Mr. INCE said he appeared for Mr. Brown, a creditor. The petition was presented on the 27th of February, but as far back as the 15th of February a notice of motion had been given, to be heard before Vice-Chancellor Bacon, raising a question whether a shareholder had been induced by misstatements in the prospectus to become a shareholder in the company. That question would affect a great many others, probably. The motion was still pending, and on the previous day it stood over that affidavits might be filed. It would, therefore, be better that all the proceedings should be in one court.

Mr. MONTAGUE COOKSON said it might happen that Vice-Chancellor Bacon never heard the motion.

Mr. INCE said his client, Mr. Brown, actually obtained his judgment for £145. He was then asked to stay execution until after the 5th of March, and, pending that stay, the petition was presented.

Mr. OSBORNE MORGAN, Q.C., appearing for the company, asked for the common order to continue the winding-up under supervision, and

The VICE-CHANCELLOR made the order as prayed.

ATTORNEY-GENERAL *v.* THE TUNSTALL LOCAL BOARD OF HEALTH.

Mr. LINDLEY, Q.C., Mr. DEVERELL, and Mr. INGLE JOYCE were for the informant and relator; Mr. DICKINSON, Q.C., Mr. M'MAHON (of the Common Law Bar), and Mr. EVERETT were for the defendants.

The object of this suit, which was instituted by the Attorney-General, as informant, at the relation of the Duke of Sutherland, and by the duke himself as plaintiff, was to restrain the defendants from causing or permitting the sewage of their district to flow into the Fowlhea Brook, and thence into the river Trent, until the same should be sufficiently purified or deodorized, or without first freeing such sewage from excrementitious or other foul or noxious matter, such as affected the purity and quality of the water in the brook and river. One of the tributaries of the Trent is the Fowlhea Brook, which for some distance forms the boundary of the district of the Tunstall Board, and after passing through Longport, the district of Etruria, and the town of Stoke-upon-Trent, discharges itself into the river Trent, which, entering the Trentham estate a short distance below the last-mentioned town, flows on by Trentham Hall, within a few yards of that mansion. The cause now came on for hearing. A great deal of evidence was adduced on both sides, and the arguments occupied the court for two days.

The VICE-CHANCELLOR, after reviewing in detail the facts of the case, and commenting on the evidence, granted an injunction, with costs, but directed that the injunction should not be enforced until the second motion day in November next.

LANCASTER SPRING ASSIZES.—TUESDAY, MARCH 9.

(*Before Justice* FIELD.)

ACTION FOR ILLEGAL DISMISSAL OF A WATER-WORKS MANAGER.

HUNTER *v.* ULVERSTON LOCAL BOARD.

In this case Mr. HERSCHELL, Q.C., appeared for the plaintiff, and Mr. RUSSELL, Q.C., and Mr. ADDISON were for the defendants.

After a consultation between the counsel, Mr. HERSCHELL stated that the action was brought by the manager of the water-works at Ulverston against the Ulverston Local Board, to recover damages for having been dismissed from his post under a contract which he entered into originally with the Ulverston Water Company. This water company, by an Act of Parliament passed on the 30th of July last year, transferred the whole undertaking to the Ulverston Local Board. The action was brought against them under a section which transferred to them the rights and liabilities in the contracts of the water company. There seemed to be a question as to whether the local board were liable, or what the nature of the liability was. His friend Mr. Russell consented to a verdict for £275. He had to state, on behalf of the plaintiff, that certain pleas were set up, alleging that he had not properly discharged the duties of manager. Now, the plaintiff had the very highest testimonials from the directors of the late water company, under whom he had acted. His friend now said that the defendants were willing to withdraw that allegation.

Mr. RUSSELL said that the allegation of negligence was merely in a legal sense, and mainly resulted from the transfer. He agreed to a verdict for £275.

The jury were directed to agree for a verdict for the sum named.

WESTMINSTER POLICE COURT.—TUESDAY, MARCH 9.

(*Before Mr.* WOOLRYCH.)

SUMMONS FOR GAS-RENT ALLEGED TO HAVE BEEN PAID.

Mr. *George Denton*, of the "Shuckberg Arms," 47, Denyer Street, Chelsea, appeared in answer to a summons, taken out at the instance of the London Gaslight Company, to recover £14 0s. 9d., alleged to be due to them for gas supplied.

Mr. ARTHUR DOVE conducted the case on behalf of the company, and Mr. W. D. SMYTH appeared for the defendant.

The amount of the claim was not in dispute, but it was stated, on the part of the defendant, that a man, to whom previous accounts had been paid, called on

or about the 20th of January, asked for payment of the account, and £14 in gold and three threepenny pieces were given to him. He handed to the barmaid what at the time was thought to be a receipt, but, on after examination, it was discovered to be simply an application for payment of a previous quarter's gas.

Mr. Dove said notice was given to the public that duly printed receipts only of the company were recognized. It was quite clear that Mr. Williams, the authorized collector of the company in the defendant's district, had not received the money, and, in addition, all the books had been searched, and there was no such entry.

Mr. Smyth said he could prove that in some instances even persons who had printed receipts had been applied to twice for payment. Mr. Smyth, in cross-examining one of the witnesses for the company, elicited that a former collector, named Booth, had been dismissed, owing to something being wrong in his accounts.

Mr. Woolrych said he was satisfied, on the evidence, that the defendant had paid the money, and he should not make any order.

Mr. Dove asked that the case might be adjourned, so that the gas company could make further inquiries, and see what course they would take.

Mr. Woolrych consented to allow the adjournment for a week, but intimated that if they failed then to alter his present opinion he should give costs against them.

Miscellaneous News.

METROPOLIS GAS SUPPLY.

Court of Common Council.

METROPOLIS GAS COMPANIES (REGULATIONS) BILL.

At this Court on Thursday, the Lord Mayor (Alderman Stone) presiding,

Deputy Fry said: I desire to ask a question of considerable importance of the chairman of the Gas Committee. I have not given him notice of it, because I quite believed that before this we should have had a report of their proceedings as to the bills No. 1 and No. 2, which have been withdrawn. No. 3, as I understand, has now been introduced into Parliament. Will the chairman now say whether that bill has been introduced into Parliament, what are the provisions of it, and whether the members of the corporation will have copies of it. We prosecute a bill in Parliament, and the members know nothing of it. I think the Gas Committee may take a lesson from the Law and Parliamentary Committee of the Metropolitan Board of Works. They come up with reports, informing the Board of the proceedings they have taken. We seem to be compelled to force information from the Gas Committee in matters that affect us and all the citizens of London. I think it would be desirable to know what the committee have been doing in reference to this matter. If the chairman will tell us in what position we stand in reference to the gas question, I think we shall be obliged to him. The question is, whether bill No. 3 has been introduced into Parliament, and whether it is desirable that we should now know what the provisions are, or whether we should wait until we see a copy of the bill, and thus get the information for ourselves.

Mr. Shaw: I wish my friend had followed the course of courtesy adopted by every gentleman of the court, and had communicated to me some notice of his question. Besides, I expected, my Lord Mayor, that you would have called the honourable deputy to order, and not have allowed him to make a long speech in asking a question, especially in reference to matters that have been decided by the court. ("No.") Well, he states he expected to have been furnished with a report of the proceedings of the committee. I thought that was decided on the last occasion, when we had a discussion here of some three hours or three hours and a half; and when the court distinctly expressed their confidence in the committee in opposition to the position taken up by Deputy Fry on this question. He has taken a position which to me is incomprehensible. On the last occasion of our meeting (and I do not say he intended to be discourteous) he put a question to me without giving me notice until I had reached the court. Then, as I understood from the feeling of the court, I answered the question satisfactorily to the court. I told him that the two bills he referred to had been withdrawn, that there was another bill, upon which we had been engaged from the first, and that it was not the result of a second thought. We have been dealing with the Regulation Bill from the commencement of entering upon the question, as submitted to us on an instruction from the court, and until it is carried in some shape we cannot report at all; there would be no good in our reporting. As I stated before, so soon as we have copies, so soon shall they be handed to members. (Hear.) That will be so. I may tell my friend, and the court at the same time, for their information, that we have had only a few copies of the bill, and that we meet this week to go through it. I must say that two or three—may be more—matters that had been agreed on as the basis on which the bill was to be founded, have been omitted—several matters of importance have been omitted. We considered them, and it was decided that those parts which had been omitted should be written out on slips of paper, and submitted again to the committee, which, of course, they would act on, when the question came before the committee of the House. There can be no objection, that I am aware of, to every member having a copy of the bill as it has been lodged in the House of Commons. I hope that will satisfy my friend, because we have had several of these questions. I will ask him to take my advice—that in future when he has these questions, which, no doubt, are of some importance, he should take the very slight trouble of writing them down, and giving them to me before the meeting of the court. Then I will answer him *in extenso*, giving the court the fullest information on the questions asked.

PURCHASE OF THE BLACKFRIARS WORKS.—A BARGAIN.

The City Lands Committee, acting on a reference of the 9th of March, 1865, reported that their attention had been called to a large block of property at Blackfriars, consisting of works lately used for the purposes of the City of London Gas-Works, and several houses adjacent thereto in Tudor Street, and they had instructed the comptroller, the solicitor, and the architect to negotiate for the purchase thereof. The officers had since recommended the purchase at £170,000—such purchase-money to include the land in front of the gas-works, reclaimed from the river under the powers of the Thames Embankment Act, and the interest of the company in the landing-stage and tunnel under the roadway, connecting such landing-stage with their works. The area purchased is not to be the rectified area containing the frontage of the new Royal Hotel, so that the corporation would be in a position to make arrangements with the Metropolitan Board of Works for the throwing back of that line. The gas-pipes are to remain on the ground until the corporation make a new street, into which they can be removed, and then they are to be removed by the company at their own expense. The ground used for the purposes of the gas-works is to be cleared by the gas company with the exception of the boundary-walls, and a site of 40 feet square is to be left to the company for a valve-house, in such part of the land as the corporation may choose, providing it be suitable for working the valves in connexion with the distributing mains of the company. The committee recommended that they should be authorized to complete the purchase, the payment to be made out of funds in the Court of Chancery, applicable to the purchase of freehold property.

Mr. Lawley (chairman of the committee) moved the adoption of the report, saying that the property purchased would not cost much more than 1s. 3d. per foot. This was very cheap for land in the City. He was proceeding to give other details concerning the purchase, when

Deputy Burnell interposed, submitting that it would not be wise to publicly enter into the particulars of this matter.

Alderman Knight took the same course, and Mr. Lawley said he would content himself with the motion he had made.

The motion for the adoption of the report was then put and agreed to.

PROPOSED INTERVIEW OF THE COMPANIES WITH THE HOME SECRETARY.

The following letter has been sent by the governor of the Imperial Gas Company to the Home Secretary:—

"Sir,—The attention of the directors of the company has been called to a speech made by Mr. Newton, at the meeting of the Metropolitan Board of Works, on the 26th of February, as reported in *The Metropolitan* of the 27th—a weekly paper said to be the recognized organ of that board—and confirmed in part by *The Times* of this morning.

"The speaker, referring to a conference granted by you to a deputation from the board and the Corporation of London, on the 23rd of February, on the subject of the Metropolis Gas Undertakings (Purchase) Bill, is reported to have said that 'an impression had been made on your mind that the supply of gas to the metropolis was in a very unsatisfactory condition, and that something ought to be done.' And again, when the deputation referred to a 'New Regulation Bill,' which the board proposed to bring before Parliament, Mr. Newton is reported to have said that you observed to the deputation, 'You will, of course, go on with your Regulation Bill?' and that you 'gave them to understand that you would give that bill your best attention, and help the board, if possible, in the matter.'

"The directors of this company have read the remarks imputed to you with great alarm, as implying that, upon an *ex parte* statement, you have been induced to encourage the Metropolitan Board to rely upon the powerful assistance of Government in coercing the gas companies of the metropolis to submit to the very arbitrary and unjust regulations which the board seek to impose upon them.

"The directors are aware that Mr. Newton's remarks may have been incorrectly reported, or that Mr. Newton may have inaccurately stated what occurred at the conference, but they take the opportunity afforded them by the fact of the Metropolitan Board and corporation having been received by you at a conference, at which the conduct of the gas companies was discussed and impeached, to appeal to you on behalf of those who have invested their capital in these undertakings on the faith of Acts of Parliament passed but recently, and after long and patient inquiry.

"The directors respectfully request that the representatives of the gas companies, or some of them, may be permitted to have an interview with you at a time convenient to yourself, in order that you may be informed of both sides of the question, before you espouse the cause of their adversaries.

"The directors of this company believe they shall be able to satisfy you not only that the proposed new legislation is uncalled for, and involves a breach of faith with the companies, but that these persistent attacks by the Metropolitan Board of Works on the London gas companies are intended to depreciate the value of a property which the Metropolitan Board of Works have avowed their wish to acquire, and hope hereafter by the policy they have adopted to purchase at a diminished price.—I have the honour to be, sir, your most obedient servant,

(Signed) "E. Vaughan Richards,
"Governor of the Imperial Gas Company.

"*Imperial Gaslight and Coke Company, 33, John Street, Bedford Row, W.C., March 1, 1875.*"

Dr. Whitmore's report on the illuminating power, pressure, and quality of the coal gas consumed in the parish of Marylebone during February:—

1875.	Illuminating Power in Sperm Candles.			Mean Pressure in Tenths of an Inch.		Mean Quanty. of Sulphur in 100 Cu. Ft.	Mean Quanty. of Ammon.in 100 Cu. Ft.	Sulphuretted Hydrogn.
	*Mean of 24 Obser.	High-est.	Low-est.	High-est.	Low-est.	Grains.	Grains.	
Imperial Comp.'s gas	16·58	17·14	15·90	23·96	9·58	23·86	0·63	No trace
Chartered Company's common gas	16·71	17·17	16·31	26·95	12·91	15·14	0·50	No trace
Chartered Company's cannel gas	23·02	23·70	22·34	17·83	10·17	18·17	0·90	No trace

Mean of daily readings of barometer . . . 29·84
" " " thermometer . . . 53·08

* Each observation consists of ten readings of the photometer, at intervals of one minute.

The mean illuminating power of the Imperial Company's gas was equal to the light of 16¼ sperm candles; it ranged between 15·90 and 17·14 candles; once it exceeded 17 candles, and 20 times it exceeded 16 candles. It should be remembered that the legal standard of this gas is only 14 candles. The mean amount of sulphur contained in 100 cubic feet of gas was 23·86 grains, and of ammonia rather more than half a grain. The mean light of the Chartered common gas was equal to 17·71 candles; it ranged between 16·31 and 17·17 candles; five times it exceeded 17 candles. The mean quantity of sulphur found was 15 grains, and of ammonia half a grain. The cannel gas gave a mean light equal to 23 candles, and ranged between 22·3 and 23·7 candles. The mean amount of sulphur found in it was 18 grains, and of ammonia nine-tenths of a grain. The pressure of all the gases was good, and no trace of sulphuretted hydrogen was at any time detected in either of them by the ordinary tests. The above results were obtained from the gas manufactured by the Imperial Company at their Fulham works, and from the Chartered Company's gas manufactured at their works, Beckton and Bow.

Hornsey Gas Company.—The ordinary general meeting of shareholders was held on Wednesday, March 10—Mr. F. Chifferiel, presiding. The report stated that the gas-rentals amounted to £3427 15s. 10d., and the products and cottage rents had realized £834 5s. 3d. After discharging all current liabilities, there remained a balance of £1518 18s. 10d. available for distribution, out of which the directors recommend a dividend for the half year, at a rate of 5 per cent. per annum, free of income-tax, as usual. This would absorb £1260 5s. 5d. The chairman, in moving the adoption of the report, said the directors were pleased to be able to recommend an increased dividend compared with that of last year, and he anticipated that the company would be able to pay a higher dividend in future. This, however, would largely depend upon the price of coal, and the profits were also largely controlled by the suburban character of the neighbourhood. the company did not possess the same advantages of water carriage for their coal as most of the metropolitan companies, but they had a wide outlying district, with but a small number of lights on each minor main, in comparison with the London districts. Therefore, although they were permitted to charge 5s. per 1000 feet as the maximum rate, yet this price did not more than equal the 3s. 6d. charged by the companies within the metropolitan district. As regarded the quality of the gas supplied by the company, it was of much higher illuminating power than required by the Act of Parliament, and it had given great satisfaction throughout the district. The resolution was seconded, and carried unanimously, and a dividend in accordance with the recommendation in the report was declared. Messrs. Gibbins and Chifferiel, the retiring directors, and Messrs. Forster and Marchand, the retiring auditors, were re-elected.

ACCOUNTS OF THE METROPOLITAN WATER COMPANIES, FOR THE YEAR 1873-4.

Statement of Share and Loan Capital, and Expenditure on Capital Account.

Companies.		Total Share Capital authorized.	Share Capital Paid up.	Loan Capital authorized.	Mortgage and Debenture Debt.	Total Share and Loan Capital authorized.	Total Share and Loan Capital Paid up.	Total Expenditure on Capital Account.
		£	£	£	£	£	£	£
Chelsea	For the 12 months ending March, 1874.	855,000	707,940	213,750	170,000	1,068,750	877,940	896,611
Grand Junction		1,000,000	911,175	250,000	222,700	1,250,000	1,133,875	1,091,623
Lambeth		1,250,000	891,580	248,000	235,950	1,498,000	1,127,530	1,094,722
Southwark and Vauxhall		1,518,000	1,263,420	482,000	372,541	2,000,000	1,635,961	1,663,870
West Middlesex		1,155,066	909,974	200,000	—	1,355,066	909,974	896,926
East London	For the 12 months ending Dec., 1873.	1,820,000	1,625,560	200,000	250,000	2,020,000	1,875,560	1,883,133
Kent		600,000	547,960	150,000	42,000	750,000	589,960	609,529
New River*		2,019,958	1,699,558	1,000,000	979,957	3,019,958	2,679,515	2,702,304

* The New River Company's shares, as established by charter, are freehold, and are divided into moieties—one moiety, or 36 parts, being held by the incorporated "adventurers;" the other moiety, or 36 parts, being originally held by King James I., and subsequently by persons now called King's Shareholders, who are not incorporated with the adventurers. Both these moieties are again subdivided, and held by numerous persons, and being real estate, are subject to entail and to trusts for minors. By this company's Act of 1852 the amount "expended" by the company in their works "then in existence" was declared to be £1,519,958 and upwards, and the capital of the company was deemed to be £1,519,958. This Act did not, however, create shares or a share capital, or alter or affect the nature, rights, or status of the property as existing under their charter, the rights under which charter are, by the same Act, expressly reserved. This Act authorized the taking of certain lands for special improvements in their then existing works; and the company were by that and by subsequent Acts in the years 1854 and 1857 authorized to raise on bond or debenture stock £1,000,000 for special improvements and for their "general purposes." The amount of this bond debt, as it existed on the 30th of June, 1873, is here set forth:—

Bonds at 4 per cent.	£370,300
Debenture stock at the same period, at 4 per cent.	609,657
	£979,957

By the "New River Company's Act, 1866," the company were enabled to create a new description of shares, declared to be personal estate, to the amount of £500,000, for their general purposes. The amount of these new shares, as existing on the 31st of December, 1873, is here set forth:—

442 fully paid (£100)	£44,200
4232 on call (£30) paid	126,960
211 on call (£40) paid	8,440
	£179,600

The dividend on these new shares is to be *pari passu* with that paid to the proprietors of the original shares of the company.

Details of Expenditure and Revenue.

Companies.	Maintenance. Reservoirs.	Distribution Works.	Pumping.	Filtration.	Salaries, &c.	Thames and Lea Conservancy, &c.	Rents, Rates, Taxes, and other Charges.	Management. Directors and Auditors.	Salaries, &c.	Collectors Commission.	Other Charges.	Total Expenditure for Maintenance and Management.	Revenue. Water-rents.	Rents of Land, Houses, &c.
	£	£	£	£	£	£	£	£	£	£	£	£	£	£
Chelsea	..	2,883	9,985	944	2,988	1,300	4,182	889	2,099	1,863	2,427	29,559	81,268	418
Grand Junction	369	4,961	19,159	1,089	3,262	1,300	6,656	873	2,554	3,221	1,930	45,375	118,183	121
Lambeth	2,273	6,095	20,544	1,025	4,584	1,250	6,008	1,247	1,562	2,530	997	48,113	117,871	58
Southwark and Vauxhall	462	4,821	27,387	2,291	3,121	1,305	6,398	1,066	2,430	4,488	1,967	55,737	134,651	..
West Middlesex	409	2,845	14,540	955	5,713	1,318	7,127	1,888	2,820	3,541	1,597	42,752	135,630	635
East London	4,292	8,009	16,085	2,423	8,752	3,587	15,479	2,160	2,927	5,185	3,091	71,990	171,776	3,860
Kent	166	2,710	13,011	..	2,597	..	4,079	1,580	731	2,184	930	27,989	68,184	357
New River	7,633	22,455	19,712	3,870	6,867	2,393	31,088	5,605	8,051	10,233	6,789	124,694	318,151	10,006

Expenditure and Revenue per Million Gallons.

Companies.	Maintenance. Maintenance and Repair of Reservoirs, &c.—including Cost of Labour and Materials.	Maintenance and Repair of Mains, Pipes, &c., and Works connected with Distribution including Labour and Materials.	Pumping-Engine Charges, Coals, Labour, &c.	Filtration—including Cost of Materials and Labour.	Salaries and Wages of Engineer, &c.	Management. Directors and Auditors.	Salaries of Secretaries and Clerks.	Collectors Commission.	Total Expenditure per Million Gallons Supplied, 1873-4.	Water-rents per Million Gallons Supplied, 1873-4.	Average Daily Supply, 1873-4.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	Gallons.
Chelsea	..	0 19 1	3 6 0	0 6 3	0 19 9	0 5 11	0 13 11	0 12 4	9 15 6	26 17 6	8,284,633
Grand Junction	0 1 9	1 3 5	4 10 6	0 5 2	0 15 5	0 4 1	0 12 1	0 15 3	10 14 4	27 18 3	11,600,832
Lambeth	0 10 1	1 7 0	4 11 1	0 4 7	1 0 4	0 5 6	0 6 11	0 11 3	10 13 3	26 2 4	12,364,417
Southwark & Vauxhall	0 1 4	0 14 1	4 0 3	0 6 9	0 9 2	0 3 1	0 7 1	0 13 2	8 3 3	19 14 6	18,704,228
West Middlesex	0 2 5	0 16 7	4 4 8	0 5 7	1 13 3	0 11 0	0 16 5	1 0 7	12 9 0	39 9 11	9,406,874
East London	0 10 6	0 19 6	1 19 2	0 5 11	1 1 4	0 5 3	0 7 2	0 12 8	8 15 5	20 18 7	22,484,976
Kent	0 1 5	1 2 9	5 9 2	..	1 1 10	0 13 3	0 6 2	0 18 4	11 14 11	28 12 3	6,529,444
New River	0 17 0	2 9 11	2 3 10	0 8 7	0 15 3	0 12 6	0 17 11	1 2 9	13 17 5	35 7 9	24,629,917

Expenditure and Revenue, compared with Previous Year, showing Increase or Decrease in each Item.

	Chelsea. Inc.	Chelsea. Dec.	Grand Junction. Inc.	Grand Junction. Dec.	Lambeth. Inc.	Lambeth. Dec.	Southwark and Vauxhall. Inc.	Southwark and Vauxhall. Dec.	West Middlesex. Inc.	West Middlesex. Dec.	East London. Inc.	East London. Dec.	Kent. Inc.	Kent. Dec.	New River. Inc.	New River. Dec.
	£ s. d	£ s. d	£ s. d	£ s. d	£ s. d	£ s. d	£ s. d	£ s. d	£ s. d	£ s. d	£ s. d	£ s. d	£ s. d	£ s. d	£ s. d	£ s. d
Reservoirs	..	651 0 0	173 0 0	..	834 0 0	..	..	16 0 0	..	59 0 0	1587 0 0	..	..	71 0 0	..	240 0 0
Do., per million gallons	..	0 4 0	0 0 9	..	0 2 11	..	..	0 0 3	..	0 0 4	0 3 2	..	..	0 0 6	..	0 0 8
Distribution	743 0 0	..	1237 0 0	..	..	152 0 0	786 0 0	..	324 0 0	..	2179 0 0	..	630 0 0	..	..	2769 0 0
Do., per million gallons	0 5 6	..	0 5 1	..	..	0 4 2	0 0 8	..	0 1 11	..	0 3 9	..	0 6 0	..	..	0 6 9
Pumping	1244 0 0	..	2469 0 0	..	4516 0 0	..	1742 0 0	..	..	893 0 0	4405 0 0	..	3097 0 0	..	4739 0 0	..
Do., per million gallons	0 10 8	..	0 8 6	..	0 11 2	..	..	0 4 10	..	0 4 11	..	0 2 7	1 9 2	..	0 10 3	..
Filtration	..	124 0 0	..	1663 0 0	..	402 0 0	80 0 0	..	33 0 0	..	403 0 0	..	..	..	1126 0 0	..
Do., per million gallons	..	0 0 6	..	0 8 4	..	0 2 6	..	0 0 7	0 0 3	..	0 0 5	..	..	..	0 3 0	..
Total expenditure	1579 0 0	..	2169 0 0	..	4060 0 0	..	1010 0 0	..	..	1345 0 0	8746 0 0	..	2870 0 0	..	4983 0 0	..
Do., per million gallons	0 18 4	..	0 2 0	..	..	0 6 4	..	0 18 5	..	0 7 1	0 4 4	..	1 12 2	..	0 8 8	..
Water-rents	2147 0 0	..	6640 0 0	..	9016 0 0	..	8108 0 0	..	5256 0 0	..	10040 0 0	..	3031 0 0	..	10123 0 0	..
Do., per million gallons	1 16 5	..	0 10 2	..	..	1 0 4	..	1 5 6	1 12 10	..	..	0 19 0	2 6 5	..	0 16 2	..

METROPOLIS WATER SUPPLY.

Dr. Whitmore's report on the composition of the Thames companies and other waters supplied in Marylebone during February:—

1875.	Total Solid Matter in degrees or grains per Imperial gallon.		* Loss by incineration of Solid Matter in previous column.		Hardness before boiling in degrees.	Hardness after boiling in degrees.
	Feb., 1874.	Feb., 1875.	Feb., 1874.	Feb., 1875.		
Distilled Water . . .	0°	0°	0°	0°	0°	0°
West Middlesex water .	20·92	21·24	0·88	0·96	14·34	4·31
Grand Junction water. .	21·24	22·36	0·88	1·00	14·98	4·41

* The loss by incineration represents the amount of organic and other volatile matters contained in an Imperial gallon (70,000 grains) of water.

During the month the water supplied to the parish was fairly bright, clear, and well filtered. The amount of solid matter, as well as the estimated organic matter, contained in the water of both companies, were slightly in excess of the average.

The Registrar-General publishes the following returns of the average daily quantity of water supplied by the London water companies during the month of February, 1875. According to their returns, 106,527,040 gallons, or 484,001 cubic mètres of water (equal to about as many *tuns* by measure, *tons* by weight) were supplied daily; or 206·6 gallons (93·9 decalitres), rather less than a *ton* by weight, to each house, and 29·1 gallons (13·2 decalitres) to each person. According to the returns of the London water companies made to the Select Committee on East London Water Bills (session 1867), it is estimated that, during the year 1866, about 82 per cent. of the total supply of water for all purposes was for domestic use. Applying this proportion to the total quantity supplied daily in the month of February, 1875, it may be estimated that about 87,352,173 gallons were probably used for domestic purposes, or about 23·9 gallons per day for each inhabitant, against 24·8 in the corresponding month of last year. This proportion doubtless varies from month to month, but the Registrar-General has no means of giving a more exact estimate.

Companies.	Number of Houses, &c., supplied in Feb., 1874.	Feb., 1875.	Aver. Daily Supply of Water in Gallons* during Feb., 1874.	Feb., 1875.
Total supply	508,465	515,552	109,013,458	106,527,040
From Thames	238,486	241,933	57,172,144	53,830,825
,, Lea and other Sources . .	269,979	273,619	51,841,314	52,696,215
THAMES.				
Chelsea	28,395	28,490	8,103,600	7,225,400
West Middlesex	45,387	46,480	8,673,611	8,869,168
Southwark and Vauxhall . .	79,550	79,914	18,126,320	15,520,000
Grand Junction	34,718	35,231	10,702,613	10,440,157
Lambeth	50,436	51,818	11,566,000	11,776,100
LEA AND OTHER SOURCES.				
New River	121,855	122,900	23,864,000	24,217,000
East London	105,562	107,294	21,674,000	21,967,800
Kent	42,562	43,425	6,303,314	6,511,415

* Including that for manufactures and for various purposes other than for domestic consumption.

Note.—The return for February, 1875, as compared with that for the corresponding month of 1874, shows an increase of 7087 houses, and a decrease of 2,486,418 gallons of water supplied daily.

Dr. Frankland, F.R.S., reports, as the result of a chemical analysis of the waters supplied to the metropolis, during February, that, taking the amount of organic impurity in a given quantity of the Kent Company's water (derived from deep wells in the chalk) as unity, the proportional amount of this impurity in an equal volume of the river waters supplied by each of the other metropolitan companies was—New River, 3·7; Southwark, 4·9; Lambeth, 5·1; East London, 5·5; Chelsea, 5·6; West Middlesex, 5·7; and Grand Junction, 5·9. The condition of the Thames continued polluted on Feb. 10, and "the water delivered by the Chelsea, Southwark, Grand Junction, and Lambeth Companies was on that date still much contaminated by organic matter in solution." Indeed, the floods had been so long continued that even the West Middlesex Company, with its "large storeage and subsidence reservoirs and admirable filtration plant," was compelled in February to deliver water which, as regards dissolved organic impurity, was no better than that delivered by the other companies drawing their supply from the Thames. The water from the river Lea, although showing further deterioration, was still superior to the Thames water. The waters delivered by the Chelsea, Southwark, and Grand Junction Companies were somewhat turbid from imperfect filtration, and the sample of the last-mentioned company contained moving organisms. The Kent Company's water continued to maintain its brilliancy, and its other excellent qualities.

CORK GAS CONSUMERS COMPANY.

The Ordinary General Meeting of this Company was held on the 9th inst.—Mr. T. MAHONEY in the chair.

The SECRETARY (Mr. D. Lane) read the directors report as follows:—

The rental from public lamps and private consumers shows an increase of £1496 over the corresponding period of 1873. This increase, however, is in a great measure to be accounted for by the advanced price which we were entitled to charge under the Provisional Order of the Board of Trade.

Although the coal market is still in a very unsettled state, which is made worse by the great lock-out of colliers in South Wales, we are glad to be able to point to a material reduction in the cost of coals, which is £1359 less than in the corresponding period of 1873. Yet we must remark that the cost of the best gas coals at the ports of shipment is still nearly double the rate which prevailed for 20 years before the extraordinary advance in price which commenced about 1872.

A manufactory is now in course of erection at the Little Island for the distillation of tar and treatment of its products, and we have made an arrangement with the proprietor for the sale to him of our surplus tar. This will ensure us a ready market at home for one of our residuals, which does not bear the cost of long carriage.

We have, under the advice of our consulting engineer, resolved, instead of lime, to employ oxide of iron, which is now universally used for purification by the London companies, and we are at present erecting a building for the revivification of this material, which, when revived, can be used over and over again. We are advised that this system, instead of being attended with additional expense, will ultimately be cheaper than the mode employed at present.

We have at considerable expense continued during the summer to test, and, where necessary, relay mains and services. This operation involved a waste of gas in the September quarter, but during the winter quarter the unaccounted-for gas was considerably diminished, and we trust, by a perseverance in this course, to reduce leakage to the lowest point which it is possible to attain under the circumstances. We have also expended a larger amount than usual on the wear and tear of works, and are resetting some of our retorts on an improved principle.

The consumption of gas in the western district having increased, we have found it necessary to lay larger mains in that portion of the city, and the supply is already greatly improved, and will soon be in a most satisfactory condition.

Although the pressure in the mains at the Lunatic Asylum is now ample, it has been proposed by the governors of that institution to erect works for the manufacture of gas, and they have been recommended to take this course on the supposition that the cost of gas manufactured by themselves would be less than the price to be charged by this company. When we remark that the calculation that has been made of the saving excludes all consideration of interest on the capital to be expended, overstates the price to be charged by this company for gas, and greatly underrates the cost of production, you will see how little reliance can be placed on an estimate based on data so erroneous. The practical knowledge of manufacturers, who have had small gas-works for some years in operation, leads them to count the cost of gas at double that represented in the estimate for the Lunatic Asylum, and the experience in several small towns of Ireland (manufacturing four or five times as much gas as the asylum requires), where the price of gas is 7s. 6d. per 1000, and where little or no dividend is earned, shows how fallacious is the estimate on which it is reported that the governors of the asylum are acting. The results of the experiment, if persevered in, must, as in the case of the Killarney Workhouse, and similar instances, be a heavy charge on the ratepaying occupiers, who would have to bear all the expense, without any contribution towards it from the landlords, and finally the abandonment of the manufacture, after a considerable capital had been uselessly expended.

You are, of course, all aware that the maximum price of gas will, from Jan. 1, 1876, be reduced to 4s. 9d. within, and 5s. 3d. outside the city.

The balance of profit and loss account amounts to £3973; out of this we recommend a dividend at the rate of 5 per cent., which will amount to £3226, and leave £747 to be added to the reserve-fund.

Capital Account.

Share capital of the company	£150,000	0	0	Amount paid on shares .	£129,200	0 0
Debentures	19,350	0	0	Ditto debentures	19,350	0 0
				Uncalled capital and shares not registered	19,746	0 0
				Due by shareholders on registered shares	1,054	0 0
	£169,350	0	0		£169,350	0 0

Revenue, for the Half Year ending Dec. 31, 1874.

Dr.				Cr.			
Coals	£11,107	14	5	Rental—			
Labour	2,490	16	4	September quarter . . .	£4,782	17	5
Wear and tear	1,893	1	8	December ditto	11,443	7	5
Ditto, proportion of suspense	344	5	9	Public lighting—			
Lime, &c.	189	6	2	September quarter . . .	739	8	6
Water and gas consumed at works	142	0	8	December ditto	1,300	13	6
Public lighting	305	0	9	Residuals	5,572	6	10
Salaries	832	10	0	Transfer fees	2	12	6
Rents	119	14	5				
Rates	788	11	4				
Advertising and stationery .	53	14	10				
Office expenses	105	7	1				
Ditto and house repairs . .	21	19	8				
Auditors	20	0	0				
Reserve for directors fees .	175	0	0				
Profit and loss	5,252	3	1				
	£23,841	6	2		£23,841	6	2

Profit and Loss.

Thirty-third dividend . . .	£3,208	3	0	Balance	£2,720	12	4
Interest—				Reserve-fund—for balance of 33rd dividend.	487	10	8
Debentures	399	15	11	Revenue	5,252	3	1
Bank, &c.	95	1	5				
Charges	146	14	4				
Insurance	37	9	4				
Provisional Order, proportion for half year	52	7	0				
Law expenses	27	6	2				
Depreciation of stock materials	220	0	0				
Bad debts and allowances. .	300	0	0				
Balance	3,973	8	11				
	£8,460	6	1		£8,460	6	1

Balance-Sheet.

Capital account—				Permanent investment to June 30, 1874. . . .	£136,180	16	6
Shares	£129,200	0	0	Extensions from above date to Dec. 31, 1874—viz.:			
Debentures	19,350	0	0	Works . . . £1,203	6	1	
Due to sundry persons . .	9,948	4	8	Mains . . . 535	13	8	
Dividends unclaimed . . .	285	19	8	Services . . 116	3	1	
Insurance-fund	793	10	2	Meters . . . 240	17	5	
Reserve-fund	371	14	9	Telegraphic apparatus . 34	10	6	
Bank, current account . .	4,190	17	1	Engineering . 102	14	0	
Profit and loss	3,973	8	11	2,233	4	9	
				Less received for account—meters and services . . 51	13	6	
					2,181	11	3
				Due by sundry persons . .	1,328	15	5
				Suspense account, *re* Collins, to June 30, 1874	1,704	3	0
				Law expenses since ditto. .	16	18	5
				Provisional Order	104	14	0
				Rental account	13,809	0	3
				Public lamps	2,102	14	9
				Stk.—coals, meters, mains, &c.	8,396	10	1
				Cork and Macroom Railway Company—invested in their debentures	1,600	0	0
				Wear & tear—suspense acct.	688	11	7
	£168,113	15	3		£168,113	15	3

The CHAIRMAN, in moving the adoption of the report, said he thought he might congratulate the shareholders on being now in in a much better position than they were at the last meeting, and at this time twelve months ago. He did not see any actual item in the report that called for remark. The general balance-sheet showed the exact state of the company's position, which was much more gratifying than it was twelve months ago. At present they owed considerably less to their bankers, and also less to the general public. Altogether they were in a very favourable condition, and for himself he could not avoid expressing his entire satisfaction with it. Turning to the report, the first item that struck him as worthy of notice was the state of the coal market. The directors were not in a position to come to any decided conclusion as to be able to state that they would get coal at a very reduced price just now. The miners of Durham were under notice to be turned out on the 13th of March, and of course if they stayed out for any considerable time the directors might be compelled to make a contract before they would otherwise desire to do so. The miners in South Wales were also on strike. This was entirely a struggle between capital and labour, but one that, in his opinion, could hardly continue for any very long period. They must, however, hope for the best. There was an item in the report referring to a new purifying process which the company were about to undertake. As Mr. Anderson was present, he would leave that subject in his hands. At a considerable expense they had altered the distributing process previously in operation, so as to give an increased supply of gas to districts where there was an increasing consumption. That involved a bad supply to some districts in the low parts of the city. For instance, when the pipes were originally laid through the city, the inhabitants of Sunday's Well were not half the number they are at present; an immense amount of building had taken place, and large establishments had since been erected—all of which involved greater gas consumption. The directors had in consequence to redistribute the mains connected with other parts, and the doing so interfered with the gas supply to these districts. There had, of course, been complaints on this head; people on

the Lower Road, for example, complained, but the directors were doing the best they could under the circumstances. They expected to be able to give an ample supply to every portion of the city—indeed, they were never short of gas, and as a fact had sent out a larger quantity during the past winter than they did that time 12 months. But they had to give the largest supply to the districts where there was the largest consumption. A great number of complaints respecting the quality of the supply had appeared in the newspapers from time to time, and some were even made to the corporation, people apparently being under the hallucination that that was the place where the gas business was managed. All he could say was that everybody who made a complaint at the office was attended to with the greatest promptitude, and everything was done to meet the emergency. The company even went outside their business oftentimes in these matters, for while their business was simply to give a supply of gas to their customers—and beyond that they ought not be expected to go—they sent their own men to examine the defects in fittings, &c. The ligitimate place, however, for making a complaint was at the office, where a book was kept for the purpose, and that book was brought before the directors every week and examined. If persons did not make their complaints in that book, it was rather too bad to hold the directors answerable should these be not attended to. He was glad to be able to state that several gentlemen who had made complaints in that way were good enough, when their wants were satisfied, to make an explanation in public. Considering that they had about 4000 customers, the number of persons who suffered any inconvenience was comparatively very small; and if the defects complained of by these had been properly attended to by their own fitters, they would never have been heard of at all. At one period of the year their manager was greatly inconvenienced by some of the men in the company's employment. It was with regret he mentioned the matter, but he thought it ought to be mentioned. The directors paid ample wages to the men for the work done; they did the best they could for them, and they certainly never expected there would be amongst the men a turn-out such as took place on the day after last Christmas Day. The men who turned out left them in such a position on that occasion that they thought they could not be done without, and later in the day returning to work, they seemed to think they should get any terms they asked. The manager, however, had supplied their places, and not only were these men not taken back, but in justice to the company, and to the community at large, the directors felt they could not overlook the matter, and had them prosecuted at the Police Office. Believing that it was a very gross and ungrateful act on the part of the men, the directors had determined that the former should never again show their noses on the premises. With regard to the allusion made in the report to the Lunatic Asylum, he should state that for a considerable time, owing to the great consumption of gas in Sunday's Well, compared with what it was when the pipes were originally laid down, the quantity supplied to the asylum was much less than the directors desired to give. Besides, when they supplied it to the institution originally, they did so through one meter placed at the gate, since the gas was taken through the entire concern. Later on the governors thought it desirable to be able to ascertain what the consumption of gas was in each of the wards, and with that view they asked the company to put a meter in each ward, so as to register the consumption. There could be no objection to that, but it compelled the company to bring their measuring apparatus up to the platform in front of the institution and make use of the pipes laid at the gate. When that was being done it was ascertained that the pipes originally laid in front of the asylum were, in consequence of the various changes made in connexion with that institution, covered over with 8 or 10 feet of surface matter, and that they were insufficient for the supply that was afterwards taken from them The rearrangement of all that took a great deal of time, and the manager and men did their utmost to give satisfaction in the matter. They also enlarged the supply by laying larger pipes through the Mardyke, and continuing them to the very gate of the asylum; and they were encouraged to go to that expense by the statement that all the governors wanted was a full supply, and if that were given there would be no complaint. They gave the full supply, yet it appeared the governors have taken it into their heads to make their own gas, and got a report on the subject from a civil engineer who stated in it that gas could be made for a certain price, and that there would be a large saving by making gas for them. The directors presumed they knew something about the price at which gas could be made; and as they were the largest ratepayers in the city—being rated at three times the amount that the next highest were rated—they considered they were entitled to point out to the board of governors that they were going to an expenditure that would not be of advantage to the institution, and that they were proceeding on erroneous data. They accordingly applied for a copy of the engineer's report; but uphappily the asylum was managed by a board appointed totally irrespective of ratepaying qualification, and totally irrespective of the ratepayers, who were obliged to contribute to the maintenance of that establishment. Unfortunately the money required for the maintenance of the asylum was not raised off the city as the poor and other rates were, otherwise there would be a sharper look-out on its expenditure. Believing that they were entitled to a copy of the report from the governors, the directors applied for it; but they not only did not get it, but they were not even favoured with a reply. He supposed that was the right thing to do—the most courteous thing for a body that was appointed by the Lord Lieutenant. Yet being rated at £3000 a year, and paying to that establishment in rates the largest amount paid in the city and county by anybody, the directors thought their voice ought to be heard, and that they ought to be favoured with a copy of the report, or at least the courtesy of a reply. If the governors wished to make gas for themselves, they of course had a right to do so; but the directors thought they were going on erroneous data in the matter; they were going on the report of an engineer who probably never made a foot of gas in his life. After some further observations, the chairman concluded by moving the adoption of the report.

Mr. DELACOUR, alluding to the patent process, said he was much disappointed at not finding a report on the subject—as to whether it was likely to be useful or not. He thought there ought to have been a decision on the point long since, and said there was a very distinct pledge given at the last meeting that it would be given this time. Considerable expense was also incurred in providing a new purifying apparatus, and if it were preferable to that already in use, all was well; but it ought to be well ascertained, before further expense was incurred, that it was an improvement on the late apparatus.

The CHAIRMAN explained that the old apparatus was to remain in action. What was proposed to be done was to substitute merely oxide of iron for lime, and the building which had been erected was absolutely necessary for the new process that was simply going further still. In that way nothing would be dispensed with.

Mr. DELACOUR said with respect to the suspense account the shareholders had good reason to be hopeful, or he might say certain, that the money which unfortunately was taken away from the establishment by the late accountant would have been made available long since.

The CHAIRMAN said the directors thought so too, and were as anxious as anybody to get it back. The question before the court was as to the company's claim to be considered salvage creditors, and to be recouped all the expenses of the arrest of the late accountant. In consequence of going to all the expense they did in connexion with that arrest, they thought they ought to be recouped the amount. The judge of the Bankruptcy Court, however, came to the conclusion that as the company had recovered all their money they should be treated as salvage creditors, as regarded the balance of the estate. That decision, put them in the position that they would have to look to the Government for the expenses of the prosecution of the accountant, which they could not do until the decision was made by the judge of the Bankruptcy Court. He did not apprehend there would be much loss; it would altogether depend upon whether the Government would look on the company as persons who made the arrest for the ends of public justice.

Mr. DELACOUR said he thought the bad debts and allowances very high.

The CHAIRMAN admitted it, but recommended gentlemen to consider the number of small accounts the collectors had to collect, and the number of times they had to call before they could get them paid. If the company threatened to cut off the gas supply in a single instance, he had no doubt they would be held up to obloquy and contempt, and it was one of the greatest grievances, in his opinion in connexion with a gas company, that a collector had to call time after time for accounts over due. He believed the most unfortunate position for anybody to be placed in was to be a collector to a gas company.

Mr. ANDERSON, engineer to the company, explained that the house erected for lime would be also required for the new purifier, alongside of which it was placed, and that there was not a farthing additional expense incurred by the change from simple lime to lime supplemented with oxide of iron. For his own part, he confessed a preference for lime altogether, but in consequence of the smell arising from its use, which the people residing around considered noxious, the directors, anxious to remove any cause of complaint on that head, determined upon using oxide of iron with the lime. That was the whole change in this respect. Having alluded to the redistribution of the gas supply touched on by the chairman, Mr. Anderson said the project entertained by the governors of the asylum of making their own gas appeared to be, in his opinion, as unfortunate a thing as the company had ever before them. In fact, he thought it would scarcely come through any other body but the governors of a Lunatic Asylum. He did not know how long the gentleman was out of that establishment when he made his report on the making of gas for it, or what his previous information on the subject was. But if his statement was that he could make gas for 3*s.* per 1000 cubic feet——

The CHAIRMAN: 2*s.* 6d.

Mr. ANDERSON said that was all the better for him. If the gentleman stated that he could make gas at that price, he (Mr. Anderson) was prepared to place in his hands, at the end of the present quarter, a couple of works. It was simply an utter delusion to think of making gas at such a price, and it was a delusion that was constantly occurring in various towns. It arose in this way—by a man putting down as the whole expense what was in reality only half the expense of the project.

The motion for the adoption of the report having been seconded by Mr. Bresnan, was agreed to unanimously.

On the motion of Mr. KELLER, seconded by Mr. M'CARTHY, a dividend at the rate of 5 per cent. per annum was declared.

Mr. E. BURKE having been moved to the second chair,

Mr. ALCOCK proposed, and Mr. DWYER seconded, a cordial vote of thanks to Mr. Mahony for the very great interest he evinced in the welfare of the company

The meeting then separated.

HARROW DISTRICT GAS COMPANY.

The Half-Yearly Meeting of Shareholders was held at the London Tavern on the 12th inst.—JAMES GLAISHER, Esq., F.R.S., in the chair.

The SECRETARY (Mr. J. L. Chapman) read the notice convening the meeting, and the following report was presented:—

The directors have to report that the business and progress of the company during the half year have been satisfactory.

The plant and apparatus are in an efficient condition, the new tank and gasholder having been completed in a satisfactory manner.

The gas-rental during the past half year amounts to £2486 6*s.*, being an increase upon the corresponding period of last year of £459 2*s.*

The value of coke, tar, &c., has for the same period amounted to £383 4*s.* 9d., a sum much less than was expected, but the prevailing low price of coke has had a most injurious effect upon the company's receipts under this head.

By reference to the balance-sheet, it will be seen that the gross profit for the half year amounts to £747 4*s.* 2d., from which must be deducted for interest on unpaid purchase-money £30 8*s.* 7d., leaving a net balance for dividend of £716 15*s.* 7d., out of which sum the directors recommend a dividend at the rate of 4½ per cent. per annum, free of income-tax, which will leave the sum of £72 6*s.* 8d., to be carried forward to the next account.

Two directors, Messrs. Glaisher and Chapman, and one auditor, Mr. Randall, retire by rotation, but being eligible for re-election offer themselves accordingly.

The CHAIRMAN remarked that, comparing the past with the preceding half year, it would be seen that the business of the company was increasing; and, speaking for himself and his co-directors, he could assure the meeting that they had every confidence in the stability and future prosperity of the undertaking. He confessed to a little disappointment, that the board were not able to recommend a larger dividend on the present occasion; it was a half per cent. more than last year, but he had hoped that it might have been one per cent. Prudence, however, dictated the course adopted by the board; but, looking to the character of the district supplied, and to the growing demand for gas, he had little doubt that at no distant period their most sanguine wishes would be realized. He moved the adoption of the report.

Mr. J. CHAPMAN seconded the motion, and said that the railway to Harrow might now be regarded as an accomplished fact. He had just heard that the land was to be purchased forthwith, and, with the development of that line, the progress of the gas company would be much facilitated.

The report having been adopted, it was resolved, on the motion of the CHAIRMAN, seconded by Mr. BAYNES—"That a dividend at the rate of 4½ per cent. per annum, free of income-tax, be now declared, and paid this day."

The CHAIRMAN said he had every reason to believe that this would be the lowest dividend the shareholders would ever receive. He felt sure, however, that the shareholders would approve the policy of the directors on this occasion. It was satisfactory to see that the business was increasing. The gas-rental had improved £533 in the last half year, and residuals £21. This latter fact was somewhat curious, considering the low price realized for coke.

The retiring directors were re-elected, and, having returned thanks, Mr. Randall was re-elected auditor.

Mr. RANDALL said he was much pleased with the confidence reposed in him by the shareholders, and could assure them that he should at all times give his best attention to the accounts of the company. He might mention that he had felt somewhat dissatisfied with the returns on coke account; but, having gone through the figures with Mr. Chapman, he believed they were as favourable as could be expected under the circumstances. He recommended the discontinuance of the sale of single bushels of coke. The fuel account was rather high; but, considering that there were single retorts in use, and that a large proportion of the coal carbonized was inland coal, he was not much surprised. He recommended the erection of a weigh-bridge at the works.

Mr. HORSLEY said the hints which had been thrown out by Mr. Randall had not been lost upon the directors. A weighing machine had been ordered; and for the future, coke would not be sold in the small quantities it had been. Speaking of the prospects of the company, he felt sure, from his knowledge of the district, they would soon be able to pay a satisfactory dividend.

A SHAREHOLDER again drew attention to the coke returns, which he said he considered most unsatisfactory.

Mr. HORSLEY admitted they were, but said the directors were compelled to follow the example of neighbouring companies, and sell at a low price, or they would not get rid of the coke at all.

The CHAIRMAN corroborated the statement, and reminded the shareholder that coke could not be stored for long, as it deteriorated so much in value. He proposed a vote of thanks to the manager of the company, who, he believed, had done everything in his power to carry on the business of the company successfully.

Mr. BAYNES seconded the motion, remarking that Mr. Chapman had had a very anxious time, and that he had loyally devoted all his energies to the service of the company.

Mr. CHAPMAN acknowledged the vote, which was unanimously adopted, and thanks having been given to the directors and auditors, the proceedings terminated.

NEWCASTLE AND GATESHEAD GAS COMPANY.

An Extraordinary General Meeting of this Company was held on Wednesday, the 10th inst., for the purpose of exercising the power of raising additional capital given to the company by the Newcastle-upon-Tyne and Gateshead Act, 1873. Alderman HEDLEY presided.

The CHAIRMAN said that under the Act of 1873 they were required to call an extraordinary meeting of shareholders to authorize the directors to raise the sum of £100,000 for extension of works, and the meeting was now called for that purpose. He thought it best to take powers to call up the whole £100,000, but it would not all be called up for some time. The directors had determined what they would first call up, as they were aware that it would be offered to public auction. Under the Act of 1873 the directors had no power to allot to the present shareholders, but the calls would be extended over something like fifteen months, so that about 20 per cent. of whatever sum they decided to call —£25,000, £30,000, or £50,000, as the case might be—would be extended over fifteen months, and there would be three months allowed between each call. This money was required for the extension of works now going on at Redheugh. Many of the shareholders would have seen what they were doing. A great deal of money had already been expended, and they would require probably £20,000 during the present year. By the end of the year they hoped to be in a position to make gas at these works. Any one who went there would be very much pleased with the way in which the work had been done. They had been exceedingly fortunate in their appointment of Mr. Wyat, their engineer. These works were similar to the Beckton works which the directors some time ago visited, and were so much pleased with, that they appointed Mr. Wyat to their works—a man who was thoroughly conversant with the erection of gas works, and so far as they had gone had given every satisfaction. Any one who purchased stock would be allowed to prepay with interest at 5 per cent. He concluded by moving—"That, under the powers of the Newcastle-upon-Tyne and Gateshead Gas Act of 1873, and the Acts incorporated therewith, the existing capital of the Newcastle-upon-Tyne and Gateshead Gas Company be now increased by the creation of £100,000 of new consolidated stock, which stock shall for all purposes be deemed part of the general capital of the company."

Mr. BROWN seconded the resolution.

The CHAIRMAN, in reply to a question, said that whatever profits there were went to the capital of the company, and had to be for the benefit of the shareholders generally. Whatever sum the directors determined upon to raise would be offered by public auction. They would bring it in just as they required it. They could not borrow upon this until they raised the whole £100,000.

The resolution was then put to the meeting and carried.

The CHAIRMAN moved—"That the said amount of new consolidated stock be sold by public auction in such a manner and at such time or times as the directors might determine."

Mr. PLUMMER seconded the resolution, and it was also adopted.

GLASGOW (CORPORATION) WATER-WORKS.

SOIRÉE OF THE EMPLOYÉS.

The Annual Festival of the *employés* of the Glasgow Corporation Water-Works was held in the South Side Assembly Rooms on the 4th inst.—Bailie SCOTT in the chair.

In addressing the meeting, the CHAIRMAN said he would not repeat the statistics with reference to the water supply of the city which had been stated at previous gatherings of the same kind. He might, however, be permitted to refer to certain experiments which had recently been made in Liverpool, and which were of special interest to Glasgow. Not long ago the supply of water in that city, which greatly resembles Glasgow as to the extent of its population, was found to be so short that it became necessary to limit the supply to 10½ hours per day. In these circumstances, the chief engineer of Liverpool considered how some check might be put upon the waste of water, and at length invented what he called a waste-water meter. This he brought before the committee, who allowed him to make a trial on a small scale, and the experiment proved so successful that an eminent civil engineer was employed to report upon the whole matter. He did so, and described the invention as in his opinion a very valuable one. Experiments were afterwards conducted on a larger scale, the result of which was that 300,000 of the population were placed under the new system. During the past year Mr. Gale the engineer to the Glasgow Commissioners, had been making observations in various quarters of the city, with the view of ascertaining the quantity of water per head which was really necessary to be supplied. On the north side of the Clyde the people were using and wasting 55 gallons of water per head per day; on the south side they could not get so much, and accordingly the consumption was less. The result of a large number of observations made by Mr. Gale was to show that 15 gallons per head per day was all that was really necessary. Now, the effect of the use of waste-water meters in Liverpool was that for 300,000 of the population, which altogether amounted to about 600,000, the quantity of water consumed had been reduced to 15 gallons per head per day, representing a saving which three weeks ago was stated to be no less than £40,000 per annum. He was sure that every one would rejoice if Mr. Gale could adopt this or some other plan by which the waste of water might be prevented, and a saving of probably £40,000 or £50,000 per annum be effected.

SPECIFIC HEAT OF GASES.—Wiedemann has succeeded in measuring the specific heat of gases, by a method which gives results as accurate as those of Regnault, while the apparatus employed is much smaller and less complicated. Two glass vessels are used, one of which may be filled with water from a reservoir 10 feet above, and the air driven from it into the other vessel, which contains a rubber bag, with a capacity of 25 litres. This contains the gas to be studied, any portion of which may be expelled from the bag by admitting water from the reservoir. Its volume is obtained with great accuracy by weighing the water collected, and correcting for temperature and pressure. The apparatus for heating consists of a tube 3 mètres long and 9 centimètres in diameter, filled with copper turnings, and immersed in boiling water. When the gas traverses this tube it is completely heated, even when 10 litres pass per minute. The calorimeter consists of three silver tubes, 63 mm. high and 9 mm. in diameter, filled with silver turnings, and which the gas traverses successively. They are contained in a silvered copper vessel, 54 mm. high and 44 mm. in diameter, filled with water. To avoid radiation the whole is enclosed in a double box of tin, which is filled with water, and brought to a temperature midway between the initial and final temperature of the calorimeter. The small size of the latter, which contains only about 60 grammes of water, enables us to obtain a considerable elevation of temperature. Thus 20 litres cooling from 100° to 20° raised the temperature 8°. To produce the same elevation Regnault required 200 litres, a serious objection, when it is difficult to obtain large quantities of the gas in a state of purity. With this apparatus the specific heat of several gases was measured with the following results, in which R. denotes Regnault's determination, and W. that obtained with the above apparatus:—Air, R., ·2377; W., ·237. Carbonic acid, R., ·2043; W., ·208. Hydrogen, R., ·3409; W., ·3431. Ethylene, R., gives ·4147 and ·3933, or ·4040 as a mean; W., ·4070 and ·3950, or a mean of ·401. The agreement is, therefore, very satisfactory.—*Bib. Univ.*, cci., 73.

BOROUGH OF BOLTON GAS-WORKS.

Account for one year, to June 30, 1874, including reserve-fund, renewal-fund, and stock account:—

Dr. *General Statement, from July 1, 1873, to June 30, 1874.* *Cr.*

Gas-rental		£59,582	8 0	Interest (bonus)		£0 18 9
Residual products—				Annuitants—1 year's annuity	14,460	4 8
Coke	7,981	17 5		Interest on bonus loans	313	7 3
Tar	2,205	8 3		Ditto on ordinary loans	840	5 3
Salts and Liquor	2,443	19 9		Cannel and coal	36,529	11 10
Spent Lime	217	17 9		Wages of workmen	4,617	4 10
Rents of meters on hire	507	6 0		Lime and purifying	1,629	3 11
Sundries	60	16 8		Retorts	1,641	3 2
Rents	177	12 6		Water	315	19 4
Fees for transferring annuities	5	5 0		Repairs	5,069	14 6
Meters and fittings sold	7,846	7 9		General expenses	110	16 7
				Rates and taxes	1,315	4 10
				Chief rent	152	18 10
				Office expenses	407	10 0
				Bad debts	195	19 9
				Law expenses	30	16 6
				Salaries	2,559	7 10
				Bank interest and commission	283	17 3
				Meters and fittings	6,521	6 9
				Renewal-fund, 2½ per cent. on £201,247	£5,031 3 9	
				Less amount paid by reserve-fund	997 16 6	
						4,033 7 3
		£81,028	19 1			£81,028 19 1

Capital Account.

Sale of land at Moxam Bottoms to the Streets Committee		£1,120	5 10	Land and buildings		£1,280 0 0
Balances, viz.—				Tank		5,449 18 11
Amount in hand, June 30, 1873	9,032	0 7		Enlargement of gasholder (Lum Street)		5,214 15 8
Amount overdrawn, June 30, 1874—				New gasholder (Spa Fields)		3,667 0 0
Sundry accounts owing to tradesmen, and interest and annuities owing	13,777	19 10		Parliamentary expenses		1,265 8 4
Deposits in hand, June 30, 1873	3,198	13 6		General expenses		55 0 0
Received since	551	7 6		Mains		3,667 4 7
Amount due to renewal account	6,285	11 7		Meters for hire		2,203 14 6
Ditto reserve-fund account	1,092	3 6				£22,803 2 0
Ditto district-rate account	3,000	0 0		Less old metal sold		107 16 11
Balance due to the bank	8,842	0 4				£22,695 5 1
		£46,810	2 8	Loans—bonus loans repaid		60 0 0
Less accounts owing for gas and residual products sold	£11,615	8 0				
Do. stocks of cannel, coke, and chemicals	6,352	10 0				
Do. meters & fittings—						
Stock	3,751	3 8				
Accounts owing	2,335	15 11				
		24,054	17 7			
		£22,755	5 1			£22,755 5 1

Reserve-Fund.

Amount included in the balance in favour of the general account		£5,000	0 0	Transfer to renewal-fund		£997 16 6
				Ditto to district-rate accounts		3,000 0 0
				Balance carried down		1,002 3 6
Balance available		£1,002	3 6			£5,000 0 0

Renewal-Fund.

Amount included in the balance in favour of the general account		£4,754	7 10	Gasholder account		£3,000 0 0
Transfer from reserve-fund, £997 16s. 6d., 2½ per cent. on £201,247	5,031	3 9		Repairs of ironwork		500 0 0
Transfer from revenue-account, £4033 7s. 3d., 2½ per cent. on £201,247				Balance carried down		6,285 11 7
		£9,785	11 7			£9,785 11 7
Balance available		6,285	11 7			

Stock Account.

Works and plant, June 30, 1873		£223,997	9 6	Loans, as per last abstract		£27,082 0 0
				Less repaid this year		60 0 0
Outlay, as per general statement		21,574	19 3			£27,022 0 0
				Floating balances—liabilities		12,602 18 8
		£245,572	8 9			*£39,624 18 8

The annuities amount to £14,460 5s. 3d.

HEREFORD (CORPORATION) GAS SUPPLY.

At the Meeting of the Hereford Town Council, on the 2nd inst., the following report of the Gas Management Committee was read and adopted:—

We have received from Mr. Sandell his report and accounts for the year and a half ending Dec. 31, 1874, which we lay before the council.

The following points appearing upon the face of the accounts are worthy of observation.

A sum of £409 1s. 10d. has been expended upon capital account, making the total cost of the works £53,932 6s. 3d.

The gross working profit amounted to the sum of £4850 9s. 3d. This will meet the interest on the loan accruing in the same period, amounting to £3584 12s., and will leave £1217 19s. 6d. available for payment of the instalment of principal. The deficiency under this head of something over £200 will have to be made up from the city fund, but no vote for this purpose is asked for at present. This amount of profit is at the rate of £3233 per annum, or £55 in excess of that for the previous year.

In addition to the information furnished by Mr. Sandell, the following comparative statement, showing the results of the working under different heads, will be interesting to the ratepayers:—

	For Year ending June 30, 1873.	Rate per Annum for 1¼ Year to Dec. 31, 1874.
Coals carbonized	4,457 tons.	4,646 tons.
Gas produced	45,898,000 feet.	48,187,334 feet.
Gas lost or unaccounted for	6,452,000 ,, or 14·05 per cent.	6,316,142 ,, or 13·1 per cent.
Average make of gas per ton of coal carbonized	10,295 feet.	10,371 feet.
Maximum quantity made in 24 hours	246,000 ,,	252,000 ,,
Maximum quantity delivered in 24 hours	257,000 ,,	259,000 ,,

We are pleased to be able to say that each head shows progress and improvement.

We regret that we have not been able to make any progress towards the purchase from the railway company of the land required for the extension of the works, and it is useless to press the matter at present, but it will have our careful attention, and we will renew the negotiation whenever a favourable opportunity occurs.

We have advertised for tenders for the mains required to light the districts recently ordered by the council to be lighted, and those works will be prosecuted with as little delay as possible.

* The works and plant and the property and rates of the borough are subject to the lien of the annuities, at 25 years purchase.

We have entered into a contract for a supply of coal for the ensuing 12 months, subject to variation, to be regulated by the rate of wages.

We have reduced the price of coke, which will be an accommodation to the public, and will enable us to get rid of the accumulation on hand. J. GWYNNE JAMES, Chairman.

Gas Office, March 1, 1875.

The following was the report of Mr. Sandell, the auditor, which accompanied the report of the committee:—

To the Chairman and Committee of the Corporation Gas-Works, Hereford.

4, *Skinner's Place, Queen Victoria Street, London, E.C., Feb.* 25, 1875.

Gentlemen,—Having received your instructions to examine the books, and make up the accounts of your Corporation Gas-Works, for the 18 months ending Dec. 31, 1874, and to prepare the necessary statements for publication, I have to inform you that I have attended at Hereford for the purpose, and in furtherance of such instructions, beg to forward you herewith the requisite information. The present accounts for publication will therefore consist of the following, viz.:—A, the capital account; B, the profit and loss account; C, the net revenue account; D, the loan redemption-fund; E, the general balance-sheet; and on inspection of which it will be seen that—

A shows the cost of the works and the subsequent expenditure, the amount of loan repaid, the amount unpaid, and the balance.

B, the profit and loss account, shows the income from gas and other sources for the period to have been £15,117 19s. 4d., and the expenditure £10,267 10s. 1d., leaving the working profit £4850 9s. 3d.; this amount is then transferred to the credit of the net revenue account, C.

C exhibits that, after payment and provision for all interest to Dec. 31, 1874, and the payment of the second instalment of the loan, there is a balance remaining of £275 17s. 6d.

D exhibits that the profit of £699 8s. 4d., brought forward from the accounts of June, 1873, and the receipt of £202 2s. 5d. from the Finance Committee, enabled the first repayment of the loan to be made, and that the second repayment was made out of the past 18 months profit, and provided for by an entry in the net revenue account.

E, the general balance-sheet, exhibits the particulars of the assets and liabilities of the undertaking, and that the assets exceeded the liabilities by the at present inappropriate profits (£275 17s. 6d.) as shown in the net revenue account, C.

Besides the accounts above enumerated, I also forward supplementary statements in reference thereto, as sale of tar, coke, fittings, &c.

Upon comparison with the previous year's accounts, it will be seen that there is an increase in the profit at the rate of about £50 per annum; and the principal difference in the expenditure appears to be in the rates and taxes, which have increased £128, the first year being at the rate of £348, and now of £476.

On comparison of the rentals for gas it would appear that there is an increase at the rate of about 6¼ per cent.

As in my opinion the present time is the period when such statements should assume a form that may reasonably be anticipated will become a standard and a precedent for the future, I have considered it essential to arrange them in as familiar a form as seemed to me requisite, and having regard to recent legislation on gas accounts, and the many different methods adopted by corporations where the borrowed capital decreased and other circumstances render such accounts at variance with the modes adopted by companies, I am not without the hope that the plan I have adopted will accomplish its intent, and meet with your approval.

In conclusion, I would add that the mode of keeping the accounts is more satisfactory than formerly, and has been fairly carried out upon the plan I previously suggested.

With a tender of any other explanation that may be required, I am, gentlemen, your very obedient servant, EDWARD SANDELL, Accountant.

A.—*Capital Account, Dec.* 31, 1874.

Dr.				*Cr.*		
Loan repaid	£1,843	12	9	Cost of works and expenditure, June 30, 1873.	£53,523	4	5
Do., balance unpaid.	53,156	7	3	Add subsequently expended, 18 months	409	1	10
				Balance of capital account.	1,067	13	9
	£55,000	0	0		£55,000	0	0

B.—*Profit and Loss Account, from June* 30, 1873, *to Dec.* 31, 1874.

Coals consumed cost	£7,010	8	1	Gas-rental, for public and private lights to Dec. 31, 1874, for 18 months	£12,815	13	9
Purifying materials	192	15	2	By residual products—			
General repairs, wear, and tear	528	10	6	Coke, less cartage, &c.	1,749	17	7
Repairs to mains and services	51	0	6	Tar	370	4	7
Lamp-lighting	255	16	4	Lime and purifying materials	30	12	11
Wages, gas-making	955	15	4	Fittings account, for profit thereon	150	15	4
Salaries	486	0	0	Abatements	0	15	2
Rates and taxes	715	10	3				
Stationery, printing, &c.	64	0	1				
Law expenses	7	13	10				
Net revenue account, for balance transferred (account E)	4,850	9	3				
	£15,117	19	4		£15,117	19	4

C.—*Net Revenue Account, Dec.* 31, 1874.

Interest paid on mortgage, June 30, 1874	£2,398	10	11	Balance brought from profit and loss account (B), being profit for 18 months to Dec. 31, 1874	£4,850	9	3
Ditto accrued to Dec. 31, 1874	1,186	1	1				
Ditto charged by treasurer	47	17	9				
Loan redemption-fund, for amount transferred to credit of account D	942	2	0				
Balance to new account	275	17	6				
	£4,850	9	3		£4,850	9	3

D.—*Loan Redemption-Fund.*

July 3, 1873—				June 30, 1873—			
Cash, paid first instalment on loan	£901	10	9	Profit and loss account, 1873, balance transferred	£699	8	4
				Cash, from Finance Committee	202	2	5
	£901	10	9		£901	10	9
July 3, 1874—				1874—			
Cash, paid second instalment on loan	£942	2	0	Net revenue account (C), amount transferred	£942	2	0

E.—*General Balance-Sheet, Dec.* 31, 1874.

Capital account, for balance at credit thereof (account A)	£1,067	13	9	Gas and meter rental—balance of this account due on Dec. 31, 1874, less deposits and prepayments	£2,615	4	10
Sundry tradesmen and others, for amount due for coals, fittings, &c., to Dec. 31, 1874	844	3	1	Coke and other residuals	539	6	7
Interest accrued and unpaid on mortgage to Dec. 31, 1874	1,186	1	1	Fittings	419	6	8
Amount due to the treasurer	1,232	7	9	Stock on hand, Dec. 31, 1874—			
Net revenue account, balance at credit thereof (account C)	275	17	6	Coals	304	10	0
				Fittings and general stk.	533	6	0
				Purifying materials	52	10	0
				Coke	56	0	0
				Tar and ammonia	16	0	0
				Gas	6	7	6
				Cash in hands of manager	33	11	7
	£4,606	3	2		£4,608	3	2

GLOSSOP GAS SUPPLY.—The Glossop Town Council, at their meeting on the 11th inst., had before them a motion proposed by Alderman Stafford, and seconded by Mr. Beeley, that a definite offer be made to the gas company for their works. The capital of the company consists of 600 original £10 shares, on which 10 per cent. dividend is paid; 600 £5 shares on which 10 per cent. is paid; and 1800 new £10 shares, on which £9 is paid up, with a dividend of 7½ per cent.; loans, £5000; total, £30,200. Alderman Stafford proposed to pay 80 per cent. premium on shares paying 10 per cent., and 45 per cent. on those paying 7½; the total purchase-money being £44,690. Mr. Roberts, while approving of the proposal, proposed to delay its adoption for a month, and Mr. Darwent seconded, thinking the offer was £4000 too high; but, except those wo, all the members of the council present voted for the original motion.

ON THE CONSTRUCTION OF GASHOLDERS.

By JOHN A. COOMBS.

[A Paper read before the Civil and Mechanical Engineers Society, Feb. 26, 1875.]

The extraordinary misconception as to the nature and construction of gasholders—a misconception shared not only by the general public, but also by engineers who have not given their special attention to the subject—induces me to think that a short description of those indispensable, though much-abused structures might not be altogether without interest to the members of this society. I purpose, therefore, briefly to lay before you the principal points usually observed by gas engineers in the construction of gasholders.

A gasholder may be described as simply a cylindrical wrought-iron bell or vessel, opening downwards into a tank of water, with a pipe or pipes passing upwards through the bottom of the tank for the supply and delivery of the gas. The vessel consequently rises or falls as the holder is being filled or emptied, its position being maintained by a series of columns or standards, which guide it in its upward and downward movements. In small holders the construction is simple enough, consisting, in some cases, merely of top and side sheets, connected by an L-iron, ring, or curb, but when they attain a diameter of 200 feet and upwards, as many of the metropolitan holders do at the present day, and when, as in the majority of such cases, a trussed circular roof has to be provided to prevent the possible collapse of the top sheets, their construction requires a much greater amount of consideration. We shall consider this evening only holders of, say, 80 or 100 feet diameter and upwards, inasmuch as the principles involved in their construction will apply, though perhaps in a less degree, to smaller cases.

Here it may be interesting to observe that in the early days of gas lighting, so great was the amount of prejudice towards the new system of illumination, that a deputation from the Royal Society, headed by Sir Joseph Banks, in examining the process adopted at the works of the Chartered Company at Westminster, recommended in their report that the Government should not allow gasholders to be erected which should contain more than 6000 cubic feet of gas, and that even these should be enclosed in strong brick walls to restrain the force of a possible explosion. The first of these recommendations is best answered by the fact that gasholders of from two to three million feet capacity are now possessed by several of the London companies, while the absurdity of the latter renders it unnecessary to point out the increased danger which would result from such a practice.

One of the first points to be taken into consideration in the construction of a gasholder is the site. As a rule, holders should be situated in the lowest part of the district to be lighted, as, in consequence of the buoyancy of the gas (the specific gravity of which is about ·4 or ·42), the requisite pressure may be supplied to the consumer with a minimum initial pressure at the works. The converse of this may be seen in the case of water-works, where the reservoirs should be placed as high as possible, that the supply may be assisted by gravitation. As a matter of fact, however, the choice of the site is generally limited by the position of the works themselves, which is more often determined with regard to the water and railway communication than for the sake of the advantages of a low level.

With regard to the number and size of the gasholders required for a given consumption, it is extremely desirable that the storeage upon any works should equal one day's maximum supply in winter. There are some provincial works, it is true, where not more than three-fourths of a day's make can be stored, but this necessitates great anxiety on the part of the engineer during the winter months, and, moreover, allows no margin in case of strikes or temporary absence of workmen.

The site and capacity of the holder being thus determined, the next question for consideration is the relative proportion of height to diameter, &c. Gasholders of upwards of 50 feet diameter are generally constructed in two lifts, on what is known as the telescopic principle, and sometimes even three lifts are employed, as at the Blackfriars works of the Chartered Company. This enables a greater storeage to be effected on a given area of ground, with a given depth of tank, though it must be remembered that the columns of the guide-framing are subject to greater strain during gales of wind—in fact, in exposed situations, it would be impolitic to construct gasholders on this principle. The great advantage of the telescopic principle is that the depth of the tank need only be one-half or one-third (according to the number of lifts) of what would be required if single lifts were employed—a very important consideration on the question of cost. An argument, however, against the use of too many lifts is that the hydraulic seals connecting them are more apt to get out of level than where only one is employed. These seals consist of a cup to contain water on the inner or upper lift, into which the grip or inverted cup of the outer or lower lift dips, so as to form an effective self-acting gas-tight joint. The cup is generally about 18 inches in depth, so that a very slight deviation from the level, especially in holders of large diameter, would seriously interfere with their proper working. The action of frost, too, upon the water in the seals frequently gives rise to great inconvenience.

As a rule, but few holders exceed 60 or 70 feet in height, the tanks being half that depth where two lifts are employed. This height is suitable for holders of 100 feet diameter and upwards. For holders of 50 to 100 feet diameter, heights varying from 20 or 30 feet to 50 or 60 feet are most common. Some engineers contend that the depth of each lift should not be more than one-fifth of the diameter, but it is impossible to follow a definite rule on this head, as the proportions have generally to be determined by the surrounding conditions. At the Beckton works of the Chartered Company—*e.g.*, exposed as they are on all sides, holders of 180 feet diameter have been erected, with a height of only 40 feet, and these, in one lift; while at the Blackfriars works, just mentioned, a gasholder 82 feet diameter is constructed in three lifts, and rises to a total height of 105 feet.

We now come to what is by far the most important question connected with the construction of gasholders—viz., How shall the roof be sustained? Shall it be supported by a trussed framing, which shall rise and fall with the holder, or consist simply of sheet iron, with no support whatever, except when at rest? Holders are mostly trussed when over 50 or 60 feet in diameter, though there are a few notable exceptions in which they have been constructed up to 150 feet diameter without trussing.

In the controversy between the advocates of trussed *versus* non-trussed gasholders, it is generally admitted that the latter have the greater part of the arguments in their favour, though but few engineers seem willing to risk the possible collapse of the roof if weighted, say, with 12 inches of snow—the maximum weight to which gasholders may be assumed to be subjected. Non-trussed gasholders, say the advocates of this mode of construction, fulfil all the conditions required of them, and are, at the same time, much cheaper than those in which the roofs are supported by trussed framing. Moreover, as is admitted on both sides, when the gasholder is at work, the top sheets never rest upon the framing so provided. Further, if the holder constructed without framing is too light to give the requisite pressure of gas, it may easily be weighted by an increased thickness of sheeting, thereby adding materially to its durability, and at the same time lowering the centre of gravity, so as to ensure greater stability. By this means it is contended that a less strain is exerted upon the columns during high winds, and that, therefore, a considerable economy may be effected by making these lighter.

These arguments, it must be admitted, are weighty, and we have now to consider what is to be said against them. In the first place, although it is true that the expense of the trussing is obviated, yet a non-trussed gasholder will require a permanent staging or framing (generally constructed of timber) to

support the top sheets when the holder is at rest. Again, non-trussed gasholders are generally, if not always, constructed with as little rise of crown as possible, partly that the permanent staging may be more conveniently and cheaply erected than if it had any considerable rise, and partly that the strain upon the top curb shall be as horizontal as possible. But the less rise the crown possesses the greater is the strain upon the curb, and if, as Mr. Hawksley has pointed out, the flat crown of an untrussed holder, 100 feet diameter, will rise 18 inches when filled with gas, it follows that the curb, or first row of sheets will be subjected to a bending and unbending which it is ill fitted to bear. This, however, is not the only prejudicial effect of a nearly flat crown, for not only the curb but the whole of the top sheets are under an enormous strain, varying, in fact, as the cosecant of the angle of rise of the crown.

With regard to the lowering of the centre of gravity of a gasholder when constructed without trussing, it does not appear that any practical advantage arises from this, inasmuch as a wind of a certain velocity will have greater difficulty in moving a heavy holder than a light one, and the distance through which the latter can possibly travel is too small to allow of any momentum being accumulated. Besides, the columns of the guide-framing, if connected with girders, and, as is frequently the case, further stiffened by diagonal rods, will always be more than sufficiently strong to resist any conceivable thrust that they may receive from this cause.

If, then, it is determined to construct a gasholder without trussing, the chief point to be observed is that the top curb shall be as strong as it can possibly be made. In some cases it consists of a box girder extending round the whole circumference of the holder; in others, a latticed arrangement of flat bars serves the purpose, and forms, together with the first row of sheets, an extremely rigid ring. In a gasholder recently erected by Mr. Woodall for the Phœnix Gas Company, the outer row of top sheets performed the part of a girder ring, having strong L-irons at the outer and inner edges, and was, moreover, assisted by another girder immediately below, formed of two $\frac{3}{8}$-inch plates, and two 6 by 6 by $\frac{3}{8}$-inch L-irons. In all these cases the object is to make the ring of such rigidity as to resist the strain tending to pull it inwards.

In the case of trussed gasholders, a variety of means have been adopted to sustain the top sheets when at rest; for, as we have seen when the holder is charged, the sheets are lifted entirely from the trussing. In a few instances the sheets are riveted to the framing, so that the whole roof becomes one rigid structure; while in others—and these form the majority—the roof sheets are secured to the framing only at the centre of the crown. In both these cases care must be taken that the ring-post in the centre of the truss is sufficiently heavy to prevent its rising before the curb when the holder is first filled, for otherwise the whole roof assumes an abnormal condition, in which the tension-rods are bearing a compressive, instead of a tensile, strain.

Till within the last year or two, the greater number of trussed gasholders have been constructed with trussings very similar to those of ordinary iron roofs, the only difference being that the ring-post has generally consisted of a tube of sufficient diameter to take the tension-rods of all the principal rafters radiating to the curb. One of the most common forms of truss have the main bars of the principals trussed with a bow-rod and struts in the ordinary manner, with tension-rods extending from the curb to the bottom of the ring-post. A gasholder of 180 feet diameter has recently been constructed on this principle by Mr. Morton, for the London Gas Company, at Nine Elms, and seems to answer all the expectations of its designer. Another form frequently met with is that in which the struts, &c., sustaining the main bars are connected immediately with the tension-rods, as is more often seen in ordinary iron gable roofs. This principle has been adopted at the new Bromley works of the Imperial Company.

A new form of trussing has recently been adopted by Mr. Wyatt for the Chartered Company. It consists of a series of wrought-iron girders extending from a ring in the centre of the crown to the sides of the holder. They do not, however, end at the curb, but are carried down the sides to form the vertical stays (which we shall speak of presently), forming a large spandril between the top and side sheets. These girders are not trussed, no ring-post is required, nothing further, in fact, than a series of purlins to connect the whole together and form a network, to which the sheets are riveted. The principle is attracting a good deal of attention from several engineers, and is probably destined to become one of the most generally adopted systems throughout the country.

It must be observed that trussed gasholders have generally a rise of crown, say, of about 5 feet in a holder of 100 feet diameter. We saw, in the case of non-trussed gasholders, that the curb had to resist the whole of the strain tending to pull it inwards. In trussed holders, on the other hand, the framing itself forms a series of struts, tending to keep the curb in position, which may therefore be made considerably lighter than in the former case.

The strains upon the different parts of the roof of a trussed gasholder may be computed by considering the holder to be inverted, and to contain water to a depth equal to the head of water representing the pressure of the contained gas.

We have hitherto been speaking only of the main bars, or principal rafters of the holder; but intermediate between these are what are termed secondary rafters, extending from the top curb about half way to the centre of the holder, and there connected with the main purlins or bracket bars which form a ring to hold the main bars in their proper position. Besides these main purlins are others generally about 4 or 5 feet apart, connecting the main rafters one to another, and also to the secondary rafters. Sometimes, too, in large holders diagonal struts are introduced between the rafters to prevent any twisting, or in place of these, diagonal tie-rods from the curb to a few of the rafters, to preserve their straightness, the remainder, of course, being kept in position by the purlins connecting the whole.

The weight of the roof of a trussed gasholder, or even of an untrussed one, is too great to be borne by the side sheets without some assistance. It is usual, therefore, to stiffen these by what are known as the vertical stays, which extend from the top curb to the bottom of the inner lift. They are, in fact, columns to support the roof when the holder is resting upon the landing stones of the tank, and may consist of ordinary plate girders, or anything combining sufficient stiffness with the requisite resistance to compression. Timber is sometimes employed for the purpose, generally, however, stiffened with L-irons. Box girders, lattice girders, trussed T-irons, channel irons, &c., have all been used at different times by engineers. In the lower lift, which has only its own weight to bear, a much lighter stay is sufficient, and generally consists either of a channel-iron or a couple of L-irons. Some engineers, however, have contended that this is inadequate, and have placed a stay on the outside of the lift to secure greater stiffness.

The bottom of the lower lift is provided with a curb, usually composed of L-irons or channel iron, extending round the whole circumference of the holder; these form the base upon which the lower lift rests upon the bottom of the tank.

With regard to the guide-framing, great diversity of opinion exists as to the form this should take. One engineer advocates columns, another standards or tripods; one connects them together with girders, more or less ornamental, another dispenses with them altogether, and puts wrought-iron tie-rods in their place. All are agreed, however, that something is required to guide the holder in its upward and downward movements, the details are immaterial. The standards are advocated because they are sufficiently strong, cheap, and, moreover, mechanical; columns are erected on account of their more pleasing appearance to the eye, especially if (as Mr. Kirkham has done at Fulham) they are designed with Corinthian capitals and fluted shafts. The girders, if any, may, of course, be left to the æsthetic tastes of the engineer. Some modern examples consist of wrought-iron girders with cast-iron mouldings, which have a very pleasing appearance. The columns, &c., carry the guides, which again are of endless form, such as rail, channel, round, T, &c. Against these guides the rollers of the carriages upon the upper and lower lifts work. The upper lift is provided with two rollers, one working against the column-guide, the other in the vertical stay of the lower lift. The outer lift has also at least two rollers, the lower one working into guides fixed on the inside of the tank.

The subject of the construction of gasholder-tanks will form the matter for a separate and subsequent paper.

The Chairman said he had listened to Mr. Coombs's paper with much interest and pleasure. The author had said that, as a rule, civil engineers knew very little about gasholders; he hoped, however, that the discussion would simply repudiate that statement. He knew that the society had many members who were well able to prove that they knew a good deal about the subject, as, after all, it was merely a question of the proper way of placing material, and that was a question which every engineer was called upon to solve.

Mr. Morrison said the paper had been so interesting and so full that there was not very much to be done in the way of asking questions. Mr. Coombs had stated that it was advisable, as a rule, to have a gasholder in as low a part of the district to be served by it as possible, and in the same connexion reference was made to water-works, in which, of course, it was necessary to have the reservoirs high, or the water would have to be forced up as high as the highest parts of the district to be served. But with gasholders the position of the site was not so material, for gas being lighter than air, it required very little power to force it from the gasholders, wherever situate. At the same time a low level was preferable to a high one, if all other conditions could be complied with. Practically, the question of level need not be considered at all; there were so many other points of more importance, such as the contiguity of railways, canals, or rivers. Far more important than the actual level of the site was the necessity of having all the mains rising as far as possible in one direction. If, for instance, a main going to the top of a hill fed a great many lamps, it would be found that very little gas would pass the end of that main. As to the fastening of the sheets of the roof to the framing, Mr. Coombs had said that some engineers approved of it, and some did not. He had always been given to understand that it was an extremely wrong course to pursue to fasten the sheets to the framing or trussing, although he knew that many engineers now considered that it was very much the best thing to do so. His own impression was that the sheets ought to be left free, for on the whole he believed it gave a better result. As to the pressure that could be brought to bear upon the ring of the gasholder—*i.e.*, the ring which connected the vertical sides with the top—it seemed to him that where the top was very flat the strain brought upon the ring would be very great indeed—very much greater in the case of a flat top than with a curved top. Where there were, two vertical sides connected by a flat top, whatever vertical pressure occurred would be equal to the pressure obtained by the weight of water; thus there would be a pressure of a $\frac{1}{2}$ lb. per square inch upon the top; but, if the top of the gasholder were curved, the strain would not be nearly so great. Having explained on the black board his formula for calculating the strain on the ring, Mr. Morrison went on to say that, as to the matter of columns or standards, he thought it was a matter of taste more than anything else, and the question was pretty well thrashed out at the institution a few weeks since. No person had yet succeeded in making a very ornamental gasholder, and probably no person ever would succeed, therefore the question was of comparatively little consequence. He should like to know whether Mr. Coombs could afford them any information with regard to concrete walls for tanks, for this was a matter of great interest. The tank was often a very troublesome affair indeed, where the foundations were treacherous, and their cost was very considerable. The usual course had been to make the walls of brick, but of late some engineers had used concrete, generally, he believed, with a facing of brick. He believed that where a good even concrete wall could be obtained, it would be found quite as good as a brick one; and, in all probability, it would be a good deal cheaper. He should be glad to know, too, from any of the gentlemen present, what had been the cost of concrete, as compared with brick, in similar works. He should also like to know whether tanks built with concrete stood as well as those of brickwork, or whether any large cracks had occurred in them; because cracks in concrete were far more difficult to deal with than cracks in brickwork.

Mr. Perrett said he had never designed a gasholder, but he had seen one blown down—one of the Beckton gasholders, which were built very low in consequence of the exposed situation. As to trussing the roofs of gasholders, he could not see, and never had been able to see, the utility of it, either as a precaution against the weight of snow or anything else. Supposing there was a thickness of 12 inches of snow spread over the whole of the top of the holder, the load, which would not be very great, would be evenly distributed. Of course, when the gasholder was let down, and the gas let out, the roof would require support, or it would collapse, and that was the only case in which he could imagine trussing to be necessary; for if there were a pressure of 6 inches of water inside the holder, it would take a great deal of snow to cause the roof to buckle. Instead of the trussing, which was carried up and down in the top of the holder as so much dead weight, it would be far better to construct a staging for the support of the roof when the holder was down. A new system of trussing had lately been designed by Captain Eads, a celebrated American engineer, and this was very applicable to the roofs of gasholders. One point which Mr. Coombs touched upon he (the speaker) thought was anything but immaterial, notwithstanding what had been said by Mr. Morrison—viz., the question of columns or standards. Now, a gasholder was by its very nature an engineering work, and it were folly to treat it architecturally. The use of columns gave the minimum of stability to such a structure as a gasholder, for, indeed, the function of a column was to support superimposed weight, and not to resist lateral thrust. Obviously, therefore, the standards or cantilevers placed on end afforded the best means of staying a gasholder, and, provided that sufficient room could be obtained for them at the base, he did not believe that Mr. Rew, or any other architect, would use the columns in preference. Mr. Coombs had not been quite just when speaking of Captain Roberts's bridge, inasmuch as he had omitted the braced trussing which was to have imparted stability to it.

Mr. Kingsford said he had not had much experience of gas engineering, but there were one or two things which Mr. Coombs had mentioned which he should like to hear explained. Mr. Coombs had given a description of the manner in which the roof of a gasholder was trussed, and at the same time had said that the strain on the roof of a gasholder upwards was the same as if the holder were to be inverted and filled with water. But, in the latter case, would any engineer design for it a tank in the same way as Mr. Coombs had sketched it? It appeared to him that if so, the struts would be where the ties should be, and that the ties were occupying the places of the struts. If the trussing were intended to carry the weight of the roof, then he could understand the mode of strutting adopted; but the trussing, as he understood, was to prevent the roof from rising too far by the pressure of the gas upwards. He had expected that Mr. Coombs would have touched upon the plan generally adopted for testing gasholders when they were made, to find out whether the workmanship was good, and whether the joints were all gas-tight. Was it done with a lighted shaving, as in the case of testing a newly-fitted gas-pipe? If so, he should not like to be the man who had to apply the test. The second plan of roof trussing described by Mr. Coombs appeared the more mechanical of the two, but he thought that if a gasholder was sufficiently stable without trussing, the trussing

should be omitted. At any rate, it appeared to him that even when trussing was needed it was carried to extremes, and the gasholders were trussed too much. If the happy medium could be hit upon, it would save material, and probably the whole would be as efficient. He had been very much pleased with the paper, and should join most heartily in thanking Mr. Coombs at the close of the discussion.

Mr. INGREY said he was unable to respond to the president's invitation to take part in the discussion, for he had never designed a gasholder, neither had he seen one blown down.

Mr. PERRETT said he wished to add to his former remark that the columns of the ill-fated Beckton reservoir were connected together by an internal flange, with probably 30 bolts. He believed that in no single case did the columns which were blown down break at the flanges, unless something had fallen across them. They all broke above or below the flanges. In the case of the round bases of the columns, which were ornamentally moulded on a square base, with four large bolts passing through the corners of the base to secure them to the foundations, large pieces of iron were torn out all round the bolt-holes, leaving the bolts in their places. These facts led him to the conclusion that, instead of four bolts in the base, there should have been something like forty.

Mr. MORRISON said that, in his previous remarks, he had gone so far as to say that the top sheeting of a gasholder ought not to be attached to the strutting, but he wished to add that he did not approve of the strutting itself, for when the gasholder was up, the strutting certainly did it no good. The pressure of the gas, when the sheets were not attached to the trussing, was sufficient to hold the roof up, and prevent its collapse. It was only when the gasholder was down that any support was needed for the roof, and the trussing or support for the roof should, therefore, be stationary at the bottom, instead of being fixed in the top of the holder.

Mr. WALMISLEY said he thought the formula given by Mr. Morrison was a very safe and valuable one. He thought that Mr. Kingsford had slightly misunderstood Mr. Coombs, and that he would see that the present system of trussing was right. If he (the speaker) was right in stating that the object of trussing was to prevent the roof of the gasholder from falling in when the holder was empty, of course, a gasholder with columns should be so trussed as to prevent any outward thrust. As to the danger apprehended from the weight of snow, he did not know what force there was in it; but he once heard Mr. Cowper say that, in one of the roofs of the Victoria Station—he did not know whether the London and Brighton or the London, Chatham, and Dover—the engineer had forgotten to allow for the weight of snow which might come upon it. He was surprised on one occasion, when visiting some gasholders in course of construction at the Battersea Gas-Works, at the enormous amount of strutting required, and he thought that engineers should seek to reduce it as much as possible without affecting the stability of the structure, and thereby obtain great economy in material and labour in construction, to the advantage of all concerned.

Mr. BREWSTER asked Mr. Coombs to explain the utility of the tension screw described by him for tightening the tie-rods in the trussing. It appeared to him that the rods were necessarily in a high state of tension. As to the weight of snow on the top of a gasholder, a cubic foot of snow weighed 17 lbs., and 12 inches of snow on a gasholder 100 feet diameter would give a weight of 133,000 lbs.

Mr. HILL said that one point not mentioned was of some interest, and one upon which it was essential that the gas or other engineers should have a clear idea—viz., what gasholders cost per cubic capacity or other standard. Perhaps, too, Mr. Coombs would say something as to the methods adopted for riveting and punching holes. He believed there was a machine at work in Birmingham which would punch 50 holes at once, which was a great advantage in saving time and labour. As to the question of columns *versus* brackets, neither were very pretty; but lately wrought-iron columns had been erected in Brooklyn, New York, not very pretty, but lighter than the ordinary columns. They were of triangular shape on plan, and were formed, in fact, of three bars of T-iron, connected by narrow bracing through their whole height. They weighed a little under 100 pounds per foot in length. As to connecting hollow columns by a large number of bolt-holes, it would be a very expensive thing to do. Sometimes gasholder columns were made with a socket-joint and spigot, which could be turned in a lathe with the greatest accuracy, and the joint was secured by iron cotters. This made a very good joint, and, when painted, it was almost invisible. Steel bracing had been used in New York for gasholders. Mr. Coombs certainly made a startling statement when he said that all the arguments were in favour of not trussing, and yet gas engineers were afraid of leaving out the trussing. He (the speaker) could not have imagined that gas engineers were the men to adopt, against their better judgment, what they considered on old and worn out-plan. For his own part, he thought that trussing was wrong in principle. Probably a third of the weight of the gasholder was in the trussing, which was not wanted at all when the gasholder was full. As to details of construction, of course in gas-works, as in other erections, the simpler they could be made the better and cheaper would they be.

Mr. R. M. BANCROFT said that the socket-joint for columns, described by Mr. Hill, had been used on the Great Northern Railway with the best results. It was a very good joint indeed for columns of a moderate size.

Mr. BOBY asked for a further explanation of the working of the hydraulic cups and seals.

The PRESIDENT said he thought one reason why the holes were torn out of the iron bases, as described by Mr. Perrett, was that there was a greater leverage exerted upon the bases, and, of course, that when Lewis-bolts, or any other bolts, were let into stone, they could not be put so close together as in joining two lengths of iron column. He thought the formula given by Mr. Morrison would be of great use. With regard to concrete walls, he should be glad to hear Mr. Morrison's question answered by Mr. Coombs, because he believed that concrete walls would be the cheapest and best, especially as the pressure would be the same all the way round. He agreed with Mr. Morrison in thinking that the bracing should be dispensed with. If the weight of the strutting were taken away from the top of the gasholder, of course the centre of gravity would be lowered. He hoped that Mr. Morrison would put his formula upon paper, so that it might be printed in the Transactions of the Society, and perhaps also Mr. Perrett would endeavour his theory to formulate as to bolt-holes.

Mr. COOMBS, in replying on the discussion, remarked that Mr. Morrison had said that he did not see any special reason why gasholders should be placed on low sites, unless other conditions, such as access by canals, railways, &c., were equally accessible from low sites as from more elevated ones. This was precisely what he (Mr. Coombs) had said. Of two available sites, choose the lowest. In some towns (Bath, if he remembered rightly) the site was on a hill. As to the fixing of the sheets of the roof to the trussing, in some of the most modern holders, constructed by Mr. Wyatt, one of the greatest authorities, the sheets were fixed to the trussing, although he (Mr. Coombs) agreed in thinking that the sheets should be free. The strain on a curved top was much greater than that on a flat roof. It should vary with the secant to the angle of rise. This would be putting a strain upon the curb, but it would not give the compression upon the curb itself. He thought he might perhaps represent the strain on the one in some such manner as this:—Supposing an iron ring, supported by a number of strings, all going up to one point. We knew the weight of the ring, and if we knew the inclination of each string, it was easy to calculate the weight upon each, but gaining the weight on each string would not give the compression upon the ring. No matter what number of strings were taken, the compression upon the curb would be the same; but this would not be the case in the other. He thought the strain upon each ring was something like $\frac{W}{n}$ or the weight divided by the number of pounds at each secant θ of the angle of rise. It was, however, a very difficult matter, and he believed that Mr. Pole had been consulted about it by one of the metropolitan gas engineers, and was unable to say how the strain on the curb could be calculated. Upon this question depended the construction of the curb. Engineers generally made it strong enough. As to columns or standards, he did not think that anything could be used with better effect than columns. The use of concrete walls for tanks had not been tried very much. It had been tried by Mr. Livesey, of the South Metropolitan Gas-Works, who reported in favour of it, and that it was cheaper than brick for tanks. At the company at which he (Mr. Coombs) was engaged, they had occasion to construct a couple of gasholder-tanks 180 feet in diameter. Tenders were invited for them, both in brickwork and concrete, and it was found that the difference in price was not 1 per cent., or anything like it. Some of the contractors tendering considered that the difficulties were so great that they would not make any reduction at all. One firm made an infinitesimal reduction. Of course, these concrete tanks had generally a lining of brick. One of the concrete tanks at the South Metropolitan was of concrete lined with brick, 9 inches at bottom, and 4½ inch at the top. He was not aware, indeed, of any tank having been built with a concrete face. The brick wall might be erected first, and the concrete thrown in behind it, which mode of construction gave a very good tank. At Bow Common works, Mr. Wyatt had had tanks built of concrete, with short piers of brickwork built in at intervals, from the front to the back of the concrete, and hoop iron was also used. As to these brick piers, he (the speaker) could not see their utility, for they completely broke the continuity of the concrete tank wall. As to cracks in concrete, personally he had not had much experience in concrete tanks, but he was not aware of any cracks having been produced in them. As to the turning over of the Beckton gasholder, as had been pointed out, the holder had got displaced by the wind in the first instance, and rested on one side, thereby pushing the columns over. This was not a fair instance to cite, however, because the columns were not intended to resist anything more than the force of the wind acting on the gasholder, 30 lbs. to the square foot being calculated in England, although it never attained that force here. As to the weight of snow, it was true that it might be evenly distributed over the whole surface of the roof of the gasholder, and yet the latter might collapse. Of course it was an old principle in mathematics, that if there was no reason why a post should fall on one side more than another, it would stand upright. It had been said that Mr. Rew, in designing a gasholder, would object to the use of columns and use brackets or cantilevers, otherwise standards; but he did not think that Mr. Rew would do anything of the kind, for he had a great idea of carrying out engineering works in an architectural way. The Doric column, in his (the speaker's) opinion, was about the best that could be used. Of course a gasholder column was sometimes twenty times its diameter, and the proportions constantly varied, although, of course, they never approached to the Greek proportions, for such would be impossible. Gasholder columns were frequently as much as 60 feet high, with a diameter at the bottom of 3 feet 3 inches, or, in other words, the length was twenty times the diameter. Greek Doric columns, however, were only ten times the diameter in height, and of course it would involve a great waste of material and space to construct gasholder columns, for the sake of proportion, 6 feet in diameter. With regard to Captain Roberts's bridge, it was only alluded to to show the great strain upon a nearly horizontal rod when only a slight weight was upon it; he did not intend to do Captain Roberts any injustice by omitting the trussing which he proposed to put over it. Mr. Kingsford had misunderstood him about inverting the gasholder. The trussing was not put in to prevent the sheets forming the roof from rising; it was only put in to support them. Gasholders were tested by being inflated with air, and, if there were any leakages, the air would be heard whistling through them, and the defects could be attended to. Of course, when the gasholder was in use, leakages could only be detected by the smell. Mr. Perrett had said that no one would have expected the columns of the Beckton holder to break at the flange, but a joint was generally looked upon as weak point.

Mr. PERRETT said he should have explained that the columns broke near their gussets in preference to any other point.

Mr. COOMBS said he was unable to explain it. As to the manner in which the pieces of iron had been torn out from around the four bolt-holes in the bases of the columns, four bolts were generally used in such cases for the sake of experience. As to trussing, he could not say that he altogether objected to trussing. He should hardly feel justified in constructing a large gasholder without anything to prevent a possible collapse of the top sheets. He did not mind the taunt about being afraid to dispense with trussing, although the arguments were against its use; it was best to be on the safe side. As to the weight of snow not being calculated for in one of the roofs of Victoria Station, he did not know who was the engineer who objected to take any notice of snow. As to Mr. Brewster's remark about the pulling-in or tension-rods, they were merely used to keep the king-post raised in position. As to the cost of gasholders, he was not prepared to say on the spur of the moment. They varied very much in cost, according to the price of labour and materials. He would, however, supplement his paper, before it was printed, with some particulars of the cost of such works, obtained from actual practice. The weight of the holder itself was easily calculated, and this, at so much per ton, would give some idea of the cost. As to the methods of riveting the sheets, in his experience the riveting machine referred to would be inapplicable to gasholder construction, in which each sheet had to be made from a template, and each hole had to be punched separately. The holes were always punched in the sheets before the latter were delivered at the works. As to columns of wrought iron, as used at Brooklyn, they looked like elongated piles, with a cast-iron capital at top and a cast-iron base below. They were very elastic, it was true, and very light. As to steel bracing, as used in New York, he had never seen any of it. As to the hydraulic seals being better and more cheaply made with channel iron than by being built up, this was true only in the case of small holders; for in large holders it was difficult and costly to get channel iron of the requisite size, it being required sometimes 10 inches wide. As to the socket-joint for columns referred to, it was very useful for small columns not large enough to allow a man to get inside to bolt the flanges together; but for columns of anything like 3 feet diameter, the flanged joint was certainly the best. He had seen the socket-joint used with very good results in smaller columns; the sockets were best made as long as possible, and with two or three cotters driven through. As to Lewis-bolts, the bolts referred to were not Lewis-bolts, but were secured into the brickwork by strong holding-down plates. As to gasholders being made topheavy by the trussing, the centre of gravity was always in the centre of the gasholder, and the interval of space through which the holder could move was too slight to give it any momentum. The extra weight, in his opinion, gave extra stability.

Mr. MORRISON having further explained his formula, and Mr. PERRETT having made a few remarks on the subject,

Mr. BOBY said he thought the reason why the columns broke near the gussets was due to the fact that there was a certain amount of elasticity in the iron, and to the unequal stretching and compression brought into play by the varying thickness of the metal. He elucidated his remarks by reference to a diagram on the black board.

Mr. WALMISLEY said he had much pleasure in moving a vote of thanks to

Mr. Coombs for his able paper, which, with the discussion which had followed it, had thrown much light upon the subject.

Mr. PERRETT said he had great pleasure in seconding the motion.

The CHAIRMAN then put the motion, which was carried unanimously, and

Mr. COOMBS having acknowledged the compliment, the proceedings terminated.

NEW LIGHTS.

From quite an early period in the history of the photographic art—we might almost say from its very origin—the attention of experimenters has been directed to the discovery of some means of carrying on their operations with the same facility at night, or in dull and unfavourable weather, as in bright daylight. The principal artificial lights that have hitherto engaged the attention of scientific men are the oxyhydric, the electric, and the light produced by the combustion of magnesium. The first named possesses no photogenic properties whatever, its spectrum containing only a very small proportion of violet rays. The electric light has been found to be available for the production of photographs, in the absence of solar rays, but its operation being very slow, a *pose* of considerable duration is necessary for the production of a picture. This light is, therefore, practically useless for photographic purposes; moreover, its net cost is rather high. The magnesium light possesses highly photogenic properties, and it may be easily produced at very trifling cost. It has been already employed in photography for taking instantaneous pictures, as well as for enlargements.

At the present time attention is occupied with a photogenic flame of considerable power, produced by the combustion of sulphide of carbon by binoxide of nitrogen. The discovery of this new light is due to MM. Delachanel and Mermet, whose preliminary researches in this matter were brought under the notice of the Academy of Sciences, and published in the *Comptes Rendus* towards the close of last year; a brief description of the apparatus employed was also given in this JOURNAL on Feb. 2 last (No. 612). It consists of a glass flask containing sulphide of carbon, on to which a current of binoxide of nitrogen is directed. In connexion with the flask is a metallic tube filled with iron turnings to prevent explosions, and at the extremity of this tube the mixture is ignited.

The flame resulting from the combustion of this mixture is not obtained without some danger from serious explosions, by reason of the combustible nature of the materials employed. MM. A. Riche and Bardy have, however, further studied this subject, with the view of obviating these dangers, either by modifying the *modus operandi*, or by suppressing the use of the sulphide of carbon; they have also compared the photogenic powers of the flames obtained by the different processes employed. According to these gentlemen, the flame of sulphide of carbon does not owe its photogenic power to the carbon, the flame of which is of a yellowish white colour, but to the sulphur, which burns with a flame of very pure blue. When sulphur, melted in a saucer or dish, burned under the action of a current of oxygen, a flame is obtained which has is an instantaneous effect upon salts of silver, notably upon bromide.

By throwing a jet of oxygen upon sulphide of carbon ignited in a dish, an analogous flame is obtained without any detonation, and it is observed that the photogenic power is greater with oxygen than with binoxide of nitrogen. As far as the apparatus itself is concerned, the experimenters found that the danger of explosion was, in fact, avoided by superficial combustion. The apparatus should, therefore, be so arranged that the current of oxygen may be directed on to the surface of the liquid burning upon a suitably disposed saucer or dish.

The following table shows the relative photogenic powers of the flames already known to scientific men, and proposed for use in photographic operations. The figures given indicate the coefficients of activity, the operations being conducted under absolutely identical conditions:—

Nature of the Light.	Coefficients.
Oxhydric light	1
Drummond light	3
Zinc burning in oxygen	4
Magnesium	5
Sulphide of carbon burning in a flask under the influence of binoxide of nitrogen	6
Jet of binoxide of nitrogen upon a dish containing sulphide of carbon	6
Jet of oxygen upon a dish containing sulphide of carbon	7
Jet of oxygen upon a dish containing sulphur	8

These observations show that the light obtained by the action of oxygen upon sulphur is that which is endowed with the greatest photogenic power. Its preparation is inexpensive, all that is required being to direct a current of oxygen on to a dish containing ignited sulphur; there is, besides, an entire absence of danger from explosion—a most essential point. The odour of sulphurous acid gas may be easily avoided by conveying the products of combustion away by means of a hood, or out of the window of the apartment where the operations are being carried on.

We advise those who are engaged in the practice of photography to have recourse to this economical light, which will enable them to operate with rapidity and certainty at times when, with the apparatus at present in use, it would be almost impossible for them to prosecute their labours; such, for instance, as during the night, or on cloudy days. They would then be in a position to utilize time which is now to a certain extent wasted, and thus turn to profitable account what, under existing conditions, cannot but represent very frequently considerable pecuniary loss.

GAIFFE'S APPARATUS FOR LIGHTING GAS.

The lighting of the hall of the National Assembly at Versailles is effected by a number of chandeliers and sconces, carrying together 256 burners. Formerly the gas had to be kept lighted during the whole duration of the sittings, but since the painted ceiling was replaced by a glass roof, the gas was lighted only at the setting in of dusk. As it was found, however, that by the process of lighting up at that time the deliberations of the Assembly were much disturbed, the practice was adopted of lighting the gas before the commencement of the sitting, leaving little flames burning all the afternoon. The desire to save gas, as well as to obviate the disagreable heat produced by so many burners, especially on hot summer days, led to the idea of lighting all the burners at one and the same time by electricity, a means which has proved effective.

The apparatus for lighting is by Gaiffe, and is described in the *Bulletin de la Société d'Encouragement, &c.* It is located in a cupboard or closed recess near the door at the left-hand side of the president's tribune, where are also the cocks for the different gas-conduits. In this cupboard is likewise a Rhumkorff electrical apparatus, of medium size, with self-acting mercurial interruption. This Rhumkorff spindle is connected with an electric battery of four elements (after Leclanché), in which the zinc has a surface of 4 square decimètres (about 64 square inches). These elements, of considerable surface, are about equal to three Bunsen's elements of medium size; but they act much longer than the latter. The Rhumkorff apparatus produces sparks of 15 centimètres (5·9 in.) long, for transmitting electricity to the different chandeliers, &c. A separate conduit (wire) is provided for each chandelier and sconce; but the reconduction of the electricity is along a common wire. The conduits are formed of copper wire, covered by three coats of india-rubber, tarred thread, and linen cloth coated with caoutchouc. In places where this cable rests upon bearers or brackets, it is further enveloped in an india-rubber pipe of 2 millimètres thickness, and the bearers are formed of blocks of hard india-rubber, pierced with cylindrical holes, through which the wires pass. Isolation is consequently perfect.

Each conducting wire ends in an isolated metallic knob, which is brought in connexion with the induction wire of the Rhumkorff spindle by means of a discharger ending in a ball, and connected with one end of the induction wire by means of a chain. The discharger has a handle of hard india-rubber; all the knobs are on an isolated iron plate, and are numbered. The other end of the induction cylinder is constantly in connexion with the reconducting wire. Both wires, the conducting and reconducting ones, are united in the chandelier which it is intended to light by a perfectly isolated metallic conductor, and have as many interruptions as there are burners. To this purpose a thick block of hard india-rubber is inserted at the basis of each burner, and between the metallic disc bearing the ball, through which pass two copper wires ending in platinum points. The different apparatus are united to each other by intermediate wires, and the ends of this interrupted chain are joined to the conducting and reconducting wires. In each lighting apparatus the distance intervening between the two platinum points is from one-third to half a millimètre; one of them dips into the escaping gas current, the other is somewhat above and outside it. Thus, combustible matter is always present at the point of passage of the spark. The spark passing over at the two ends of the conductor is much shorter than that produced in the apparatus; its length decreases from 15 centimètres to 25 millimètres; but, notwithstanding this difference, the discharge is sufficient to overcome with perfect safety the fifty-four interruptions of one-third of a millimètre which are in the conductors of the larger chandeliers.

When the gas is to be lighted, the spiral of induction is put in motion by closing the current of the galvanic battery by means of a lever provided with an india-rubber handle; the gas-cock is then opened, and sparks are produced by means of the discharger on the knobs corresponding with the different conducting wires. The process of lighting up lasts scarcely 15 seconds. The sconces of the tribune, which must be served by very extensive conductors, take one minute and a half to light; they must be lighted separately. At the moment of ignition, the apparatus is fully charged with electricity, accumulated while not in operation. The discharge is consequently more powerful than is absolutely necessary for obtaining the desired effect. This advantage secures the proper operation of the apparatus, even in very damp weather. If the apparatus were used a number of times in rapid succession, it would cease to have the desired effect. Tested to its utmost limit, it was found possible to ignite the gas twenty times in rapid succession without mishap. The efficiency of the apparatus is therefore established.

As the electric battery is in use for only two or three minutes daily, its wear and tear is inconsiderable; it is, however, advisable to take care not to leave the current closed after its use. To prevent this happening, M. Gaiffe has so arranged the lever interrupting the current as to secure its being pressed down by the letting down of the sliding door closing the recess.

The conducting wires have a length of 1400 mètres (1526 yards). The saving in gas effected by the use of the apparatus is said to be considerable.—*The Builder.*

IRON AND COAL TRADES OF SHEFFIELD, SOUTH YORKSHIRE, AND NORTH DERBYSHIRE.

(FROM OUR OWN CORRESPONDENT.)

The local iron trade is by no means brisk, but there are not wanting indications, in several instances, of an improvement having at last set in. This amelioration is, certainly, by no means widespread, but it is clearly valuable as a token of what may reasonably be expected to follow at such establishments as have not yet experienced any material influx of orders.

In the meantime matters have a very unpromising appearance in connexion with the various companies in the iron trade in this district, on the "limited" liability principle. Many of these concerns were started during the busiest period the iron trade has ever known, and being floated on the very summit of the wave of prosperity, have, in the major number of instances, never yet answered the expectations of those who were confiding enough to invest in them. Some had too much capital, others an insufficient amount, both causes being detrimental to the interests of the respective concerns. Several cases in point have from time to time become known in this district. Within the past week the shareholders meetings have been held of Brown, Bayley, and Dixon, Limited; the Charlton Iron-Works Company, Limited; and the New Sharlston Collieries Company, Limited; at which, in each instance, statements were made, proving the truth of what has just been remarked.

Messrs. D. and W. Lockwood, carrying on a foundry business as Lockwood and Foster, at Attercliffe, Sheffield, filed a petition for liquidation on Thursday, their liabilities being nearly £6000. There is, as a general rule, a tolerably good business doing at the local and district foundries on pipe work, builders and colliery castings. The Leeds Water-Works Company are now obtaining tenders for the supply of its 3-inch and 4-inch pipes for the current year, and the Horbury Local Board are about to lay 15,000 yards of socket-pipes, of from 8-inch to 3-inch diameter. These orders will doubtless find their way into the West Riding or the Middlesbrough district, prices being now exceedingly low in the latter for ordinary classes of main-pipes. It is even said that offers are being sent out at no higher price than £6 5s. per ton! During the week the miners delegates and a committee of the Coalowners Association have met, and the latter put forward a proposal that wages should be reduced 10 per cent. This proposition was discussed on Wednesday at a delegate meeting of the men, held at Barnsley, and, after a deliberation lasting some time, it was decided to leave the separate "lodges" to form their own decisions, and to send their delegates with answers to a further meeting on Monday next. The men are understood to be, naturally, averse to submitting to any reduction in wages, but it is believed that they will agree to accept it in the face of the dull state of trade, and powerful organization of the employers. The coal trade remains very quiet, although steam coal is still in tolerably good request.

IRON AND COAL TRADES OF SOUTH STAFFORDSHIRE AND EAST WORCESTERSHIRE.

(FROM OUR OWN CORRESPONDENT.)

There is no appreciable change in the condition of the finished iron trade of this district since last report, and manufacturers experience increased difficulty in maintaining their works at anything like full production. Small orders for home consumption continue to be given out, but the large exporters complain of their inability to do business at current rates. Marked iron is tolerably steady on the basis of £10 10s. per ton for bars, with the usual extras for Round Oak B.B.H. and other noted brands. Common (unmarked) bars are selling at £8 15s. per ton, and other classes, with the exception of sheets, in the usual proportion to that standard.

The sheet mills continue fairly active, best thin sheets of favourite brands and ordinary sheets adapted to the requirements of corrugated roofing manufacturers being among the more prominent features of current inquiry. The pig iron branch is quiet; the competition of the producers of the Cleveland district now presses rather severely upon local makers of medium and common qualities. The current rate is at £3 to £3 5s. for common cinder pig, £3 15s. to £4 for mixed mine, and £5 to £5 5s. for all-mine of good quality.

The ironfounders continue fairly occupied on machine and general castings, and report a full average demand for gas and water pipes, socket and spigot

pipes, from 3 to 6 inch, are quoted £6 10s. to £7 per ton; and 7 to 12 inch vary from £6 to £6 10s., according to quality.

At Wednesbury the unhappy dispute in the wrought tube trade is still unsettled, nor is there at present any indication of an early adjustment of the difficulty. The fifth weekly distribution of strike allowance was made on Tuesday last, the married men receiving 14s. each and 6d. for each child, and the single men 9s. each, being an advance of 1s. on last week's pay, and youths received 5s. each. The operatives continue to receive substantial assistance from distant organizations, the principal contribution of last week being £30 from the Newcastle Nine Hours League. The Gateshead Relief Committee and St. Helen's Nine Hours League have also again given assistance. The industry continues much depressed, and manufacturers now rely upon an early revision in the prices of iron and coal as the only source of permanent improvement to the trade.

The coal trade, excepting for best household qualities, is inactive, on the Wolverhampton side of the district. Common forge coal may be had as low as 8s. per ton at the pits, and slack at 2s. 6d. to 3s. per ton, but the best qualities still command 13s. to 14s. In the Dudley district, the price of Earl Dudley's thick coal, which practically rules the market, is still unchanged; but sales are not so free as formerly, and in some cases stocks are beginning to accumulate. The strike in South Wales gives some little stimulus to the demand, or a reduction must speedily ensue.

THE COAL AND IRON TRADES OF LANCASHIRE.

(FROM OUR OWN CORRESPONDENT.)

All good classes of coal continue to meet with a very fair demand in the Manchester market at full rates; but amongst smaller proprietors, who have only inferior descriptions to sell, there is a good deal of running about for orders, and less money is being accepted. Generally, the market is not so firm as it was. There is an expectation in some quarters that prices will be reduced at the end of this month; but from what I can learn, there is no indication at present that any of the large coalowning concerns will alter their rates, stocks being as yet too low to warrant such a step being taken. In house coal, orders are still in arrear, and good furnace fuel and burgy are in active request. For best slack there is also a better inquiry, in consequence of brick-making now commencing; but common descriptions continue a drug. For gas coal and cannel it is now the quiet season; but although the actual amount of trade being done has naturally fallen off, there are plenty of inquiries in the market, on the part of merchants, for quotations. Unscreened gas coal at the pit mouth is quoted at about 10s. to 11s. per ton; screened, at from 13s. to 14s.; and for ordinary cannel, at the pits in the neighbourhood of Manchester, the list rates are about 22s. 6d. per ton, Wigan cannel being worth about 7s. 6d. per ton more than this.

In the outside districts there is only a moderate amount of trade doing; supplies are plentiful, and prices are weaker, although no actual alteration has been made in the list rates.

The Liverpool shipping trade is dull, caused by consumers holding back in anticipation of a reduction, and the east winds having kept vessels from the port.

In the coke trade there is a fair local demand, and prices range about 12s. per ton for small, and about 22s. per ton for best coke at the pits.

The iron trade of the district continues exceedingly dull. Founders complain of a scarcity of orders, but forge people are, if anything, a trifle better off, although by no means well supplied with work. For Middlesbrough qualities of pig iron, delivered in the Manchester district, the quotations are as under:—No. 1 foundry, 73s. 9d.; No. 2, 71s. 3d.; No. 3, 67s. 3d.; No. 4, 65s.; and No. 4 forge, 64s. 9d. per ton net cash. Manufactured iron is flat, and prices are again rather easier. Ordinary bars delivered are quoted at about £8 15s. per ton, and puddled bars about £5 15s. Rails are about the same as last quoted.

THE COAL AND GENERAL TRADE OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

There were considerable arrivals of vessels in the coal ports last week, but they were mostly ships of large tonnage. There was a scarcity of small vessels, and former coasting rates were fully sustained. The household and gas coal trades remained remarkably quiet. Gas coals were quoted at from 8s. to 12s. per ton, less 2½ per cent. Household coals, for export, 12s. 6d. to 15s., less 2½ per cent. Steam coals, 14s. to 16s. per ton, less 5 per cent. Small steam, 10s. to 11s. per chaldron, less 2½ per cent. Coke is very firm at late quotations.

The wages dispute in the Durham coal trade has been settled by the coal-owners and the delegates from the men agreeing to refer the points to arbitration. The award of the arbitrators, who have been inquiring into the wages question in the Northumberland coal-field, will be made known this week. Until the wages question is thoroughly settled in the coal trade, there will be no steady business. At present trade is particularly dull in the North of England in all its branches, and the miserable quotation of 10s. to 11s. per chaldron for small steam, which is just £1 per chaldron below the highest point that prices reached in the busy season of three years ago, shows that there is a very limited manufacturing demand.

It is very difficult to arrive at an opinion with regard to the spring prospects of the coal trade here. The Baltic will be a month behind ordinary seasons this year in opening to trade, and, under the circumstances, Baltic merchants are keeping their orders out of the market. There is a fair demand for the Mediterranean and the coasting inquiry is tolerably steady; but the best test to apply to the trade is to ascertain how much the lock-out in the South Wales district has affected the steam coal trade of the North. Orders have undoubtedly come to the Tyne, which, under ordinary circumstances, should have gone to South Wales. But, notwithstanding this, it is an equally well-known fact that the large steam collieries of Northumberland are consigning coals to Hamburg, France, and other places, not having a market for them. There is an impression that if the South Wales men had not been locked out, the Northumberland collieries would have been working little more than two or three days in the fortnight. The steam trade will, of course, improve in April; but there will be a falling off in the demand for household and gas coals. Without there is a revival in the iron trade, it is difficult to see how gas and household coals can maintain their present quotations.

Coal freights to London fell about 3d. per ton last week, and there was a considerable falling off for vessels to load coals for the French ports. Small vessels continue to be in request to load fire-clay goods and bricks at 8s. 6d. per ton for London.

The Cleveland iron market has been tolerably steady, especially after it became known that the Durham coalowners and their men had agreed to arbitration. There has been a somewhat increased demand for pig iron; but the finished iron trade showed little change. Messrs. Bolckow, Vaughan, and Co., Limited, have declared a dividend of 12½ per cent. on their ordinary shares. But this is very exceptional to the ordinary course of business in the iron trade just now, and is accounted for by the fact that this large company have iron-mines, blast-furnaces, and rolling-mills and collieries all within themselves.

The chemical trade of the Tyne is extremely quiet. There has been an improvement in the price of crystals of soda, and some other articles; but it is very little. The dispute in this trade is likely to be settled by arbitration.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

At the meeting of the Glasgow Town Council, held on Thursday last, it was announced, on behalf of the Gas Committee, that the application made to the Board of Trade for an extension of the Provisional Order for another year, so as to maintain the price of gas at 5s. 5d. per 1000 cubic feet, could not be granted, as the Board of Trade had no power to do so. The committee also stated that it was not expedient to apply for a private Act to confer the powers asked from the Board of Trade. Mr. Treasurer Miller, in moving the approval of the minute, said the consequence was that they would be obliged in November next to reduce the price of gas to 4s. 7d. He hoped that when that time came the price of coals would be so far reduced that they would be able to make gas and sell it at 4s. 7d. He could not give an opinion upon that subject at the present time, but they would certainly be obliged to reduce the price of the gas.

For some time past the householders in Helensburgh have been dissatisfied with the rate charged for gas by the gas company of that town, the rate being 7s. 6d. per 1000 cubic feet; and some dissatisfaction has also been felt at the accounts rendered by the gas company for the past quarter, which are said to be considerably in excess of those for the corresponding quarter of last year, though the rate has been unchanged. An indignation meeting was held on the subject last Tuesday evening, and Provost Stevens, who presided, announced that the directors of the company had agreed to reduce the price 10d. per 1000 feet from Whitsun-day next—that is, after the winter's gas was consumed—but that was not sufficient in his opinion. After a good deal of strong speaking, with numerous references to other places where gas is consumed, several resolutions were passed, with the view of meeting the circumstances of the case. It was also agreed to petition Parliament in favour of Sir Wyndham Anstruther's bill for enabling Town Councils and Police Commissioners to build and maintain gas-works.

Grumbling is now showing itself at Perth, the grumblers being a most influential body—to wit, the General Railway Station Committee. At a meeting of the Gas Committee held on the 8th inst., a letter was read from the secretary of the Station Committee, stating that unless a considerable reduction was made in the price of the gas supplied to the railway companies, they would make arrangements for supplying themselves with the gas they require.

The town of Arbroath narrowly escaped being thrown into darkness on Monday night by an accident which occurred at the gas-works. It seems that the masonry work on which the hydraulic main rests had been so much injured by the action of the heat that the main broke. The Gas Committee had the matter under consideration on Tuesday, when Mr. Robert Brown, the manager of the works, gave it as his opinion that, as the factories do not now require gas, he would be able to keep the town supplied, and at the same time overtake the repair of the damaged masonry.

On the recommendation of the corporation Gas Committee of the Town Council of Aberdeen, it has been remitted to the superintendent of the gas-works and the gas treasurer to report as to a proposal to have complete communication by rail both from the harbour and the Caledonian Railway Company's station into the gas-works; and it has been agreed to borrow £5000 on mortgage for gas purposes, for three or five years, from May 15, 1875, at 4 per cent. interest per annum.

At the last meeting of the Town Council of Irvine, it was reported that the Law Committee, having fully considered a motion made by Captain Clark, one of the members of council, as to the erection of gas-works by the burgh, had unanimously agreed that they considered it incompetent and illegal for the burgh, as a corporation, to erect gas-works, as proposed, without parliamentary sanction; and further, that it would not be for their advantage to take steps in the meantime to disturb the arrangement between the burgh and the gas company with regard to the supply of the burgh and harbour lamps with gas, the rate charged being very moderate.

The iron trade is very dull, both in the pig iron and the malleable departments. In the beginning of the week the price ranged from 74s. 9d. to 75s., but by Thursday it was down at 73s. 3d. to 73s., and on Friday there was practically no change. Several special brands of makers iron have been reduced in price 1s. per ton during the week. There does not seem to be any prospect of an immediate improvement in the demand. On the whole, the shipments are certainly better than they were at the same time last year.

There is a good deal of dulness in the coal market, and prices are tending downwards. The rates at the Glasgow Harbour cranes are 8s. 6d. to 9s. 6d. per ton for Wishaw Main coal; house coal, 9s. 3d. to 14s. 3d.; splint coal, 9s. 6d. to 10s. 3d.; steam coal, 10s. to 12s.; smithy coal, 15s. 6d. Prices are also tending downwards in Fifeshire, and the miners in that part of Scotland are threatened with a 20 per cent. reduction on their wages.

TESTIMONIAL TO MR. A. T. WALKER.—On the 6th inst., the workmen of the Cambridge University and Town Water-Works Company presented their foremen, Mr. A. T. Walker, with a handsome silver cup, as a mark of their respect for him, on the occasion of his leaving to assume the sub-managership of the Reading Corporation Water-Works.

ALLEGED THEFT OF GAS IN GLASGOW.—A man named Duncan Bramble was remitted from the Glasgow Eastern Police Court, on Wednesday last, to the justices, on a charge of having, between the 30th of September and the 28th of January last, stolen 3000 cubic feet of gas. Accused's gas had been cut off, and he had attached a pipe to the meter, and thus got light.

SALE OF GAS SHARES AT BURY ST. EDMUND'S.—On the 8th inst., 35 original £10 shares, and 103 new shares (£5 10s. paid), in the Bury St. Edmund's Gas Company, were by the directions of the trustees of the late Admiral Syer, sold by auction, in lots. The first lot of five original £10 shares sold for £20 a share, and the remaining thirty sold for £20 5s. each. The new shares (£5 10s. paid up) ranged in price from £8 5s. to £8 10s. each.

GLASGOW WATER SUPPLY.—Professor Bischof, of the Andersonian University, Glasgow, reports that the water supplied to that city last month, although turbid and containing much suspended matter, was free from all evidence of animal contamination.

LONDON STREET-LAMPS.—A return to an order of the Metropolitan Board of Works has just been printed, which shows (*inter alia*) the increase that has taken place in the number of street-lamps in London, from the 1st of January, 1856, the date of the Metropolis Local Management Act coming into operation, to the 25th of March, 1874. The principal increase has been in the following parishes:—

St. Pancras	1867
Lambeth	1311
Islington	1246
Kensington	2275
Wandsworth	1459
Lewisham	1175

Not a single new lamp appears to have been erected in the parishes of St. Luke, or St. Martin's, or in the Strand district. The total increase during the 18¼ years was 17,480.

PHILADELPHIA GAS-WORKS.—The amount of gas made in these works in 1874 was 1,766,268,000 cubic feet, an increase over the year 1873 of 117,681,000 cubic feet. The largest consumption in any 24 hours was on the night of Dec. 24, amounting to 7,826,000 being an increase over the largest of last year of 787,000 cubic feet. The street-mains laid during the year were 36,262 feet,

making the entire length of 615 miles. The whole number of lamps on Feb. 1, was 9905; 9441 are supplied with gas from these works, and 464 with gas from the Northern Liberty Works.—*American Coal and Iron Record.*

GAS-WORKS IN JAPAN.—An esteemed correspondent, writing from Hiogo (Japan) in January last, says: "It may be interesting to you to know that gas-works in this country are going ahead. These works commenced making gas on the 1st of September last from Japanese coals, some of which are of good quality, but their produce per ton does not come up to most of the English caking coal, being, on an average, 8000 cubic feet per ton, of an illuminating power, per 'London' burner, of 15·5 candles. These works belong to a private company, all Europeans. In Yokohama they have had gas-works in operation nearly two years; the company there are Japanese. In Yedo the works have been completed within the last few days. They are small works, and to light the town properly they would require, at least, two more of the same size. That is also a Japanese company. At Hiogo the charge for gas is $4 per 1000 to private consumers. The public lamps are charged $2·50 per month. Coals cost us $5 per ton, delivered in the store. Trade is very dull at present; in fact, there is nothing doing, and people will not lay out money on gas or fittings, which is a great drawback at the start of new works."

FOREIGN SHIPMENTS OF PIPES, GAS COAL, &c., FROM SCOTCH PORTS.—The following shipments from Scotch ports have recently been reported:—To Singapore—cast-iron pipes and fittings, 2 tons, £40, and 576 tons, £4300. To Monte Video—fire-clay pipes, 110 tons 15 cwts., £272. To Rangoon—coal tar, £6. To Antwerp—malleable iron tubes, 42 tons 13 cwts., £756, and 6½ tons, £160; benzole, £910; gas coal, 700 tons, £700. To Calcutta—cast-iron pipes, 5 tons 7 cwts., £35; malleable-iron tubes, 1 ton 11 cwts., £40. To Rio de Janeiro—gas coal, 1095 tons, £2460; cast-iron pipes, 162 tons 6 cwts., £1204; lamp-posts, £50. To New York—gas coal, 551 tons. To Boulogne—coal tar, 15 barrels. To Oporto—cast-iron pipes, 11¼ cwts., £5. To Bordeaux—paraffin wax, £356. To Mauritius—gas coal, 115 tons, £221. To Otago—malleable iron tubes, 3 tons 8 cwts., £73. To Lisbon—malleable iron tubes, 7 tons 10½ cwts., £145; cast-iron pipes, 1 ton 16 cwts., £14. To Rotterdam—cast-iron pipes, 8 tons, £103, 5 tons, £30, and 10 cwts., £4 5s.; fire-bricks, £211; fire-clay pipes, £219. To St. Thomas—fire-bricks, 38 tons, £35. To Dunkirk—malleable iron tubes, 212½ cwts., £268. To Coquimbo—fire-bricks, 48,800, £196.

MUNICIPAL CORPORATIONS (BOROUGH FUNDS) ACT.—On Thursday last a deputation of the Association of Municipal Corporations waited on the Home Secretary, at the Home Office, to urge on him the repeal or alteration of the Borough Funds Act, 1872. The deputation was introduced by Mr. Torr, M.P., and the memorial which they presented was signed by representatives from the Municipal Corporations of London, Liverpool, Manchester, York, Birmingham, and nearly 100 other cities and towns of England. Mr. Cross, in the course of his reply, said that with respect to the extension of the powers given by the Act, it was worthy of consideration, as was also the provision requiring a majority of the whole governing body. He could not, however, assent to doing away with the power requiring an absolute majority of qualified persons entitled to vote. To do away with the provision requiring the sanction of the owners and ratepayers to any expenditure, and asking for any necessary expenses incurred to be allowed by some person appointed by the Local Government Board, would place a strong argument in the hands of those who opposed such expenditure, that there ought to be some control exercised by those outside the governing bodies. He could not, therefore, consent to that. With regard to the check and control of the ratepayers over expenditure, he did not hesitate to call that a clumsy arrangement. No body of persons were more incompetent to decide the fairness of an expenditure on one particular point than the whole mass of ratepayers, for they could not spare the time to consider sufficiently whether it was warranted or not. At the same time, something was to be said on the other side of the question. The Government were considering the point. He was entirely with them upon the principle of their objection to this state of things. Whether he could carry out their views this session must depend upon public business.

Register of New Patents.

2274.—CONNELL, W., Glasgow. "*Improvements in valves for water-supplying apparatus.*" Patent dated July 1, 1874.

In one modification of these improvements adapted for water-closets, a valve piece arranged to close the outlet from the bottom of a cistern is attached to the rod of a piston working in a main cylinder, and in connexion with this main cylinder there are two lateral cylinders having in them pistons which are connected to a weighted lever, and one on each side of the fulcrum of such lever. The lever is connected to the closet handle, and on lifting this, one of the lateral pistons is depressed, which action forces water through a small valve into the main cylinder, and thereby raises the piston in the latter. The main piston in rising opens the main valve, but both begin to descend again, because the water escapes from under the piston through an aperture. After the handle is lowered the weighted lever reverses itself, and by depressing the second lateral piston forces water into the main cylinder, and thereby again lifts the piston and with it the main outlet-valve.

2315.—BENTLEY, J., Birmingham, "*An improved sanitary apparatus or pump for raising and delivering sewage or other diluted refuse matter, but which said apparatus is also applicable for elevating and delivering water or other fluids.*" Provisional protection only obtained. Dated July 3, 1874.

The novelty of this invention consists in raising and discharging sewage or other diluted matter by means of a spiral of any desired length and pitch being made to revolve by suitable gearing, worked by steam or other motive power within a cylinder. The internal circumference of the cylinder being the same size as the spiral, causes a continuous stream of sewage or other matter to be elevated and delivered.

2318.—KUNSTADTER, J. J., Camomile Street, London, "*Improvements of apparatus for causing the flow of liquids, and also in apparatus to obtain motive power from the flow of liquids.*" Patent dated July 3, 1874.

The apparatus for causing the flow of liquids consists of two tanks, in each of which are platforms or floats of less specific gravity than the liquid, thus having a constant tendency to float to the surface, but are pressed down by weights or springs properly adjusted so as to press down the liquid. At the bottom of each tank is a pipe leading to the top of the other tank. When used with the apparatus forming the second part of the invention, one of these pipes must be of flexible material. The liquid is driven out of one tank, by the pressure of the floats, through the pipe from the bottom of that tank, to the top of the other tank, which is partly filled with air. The liquid falling to the bottom of the second tank is driven by the floats thereof through the pipe from the bottom of that tank to the top of the first tank. A constant circulation is thus kept up.

The apparatus for obtaining motive power from the flow of liquids consists of a wheel formed of two discs with friction rollers so fixed on its periphery as to revolve freely. The flexible tube being pressed against the friction rollers, the motion of the liquid passing through it causes the wheel to revolve. The motive power thus produced may be used in any of the ordinary ways.

2330.—COLLS, F. W., Erith, "*Improvements in traps for preventing the escape of gases from sewers and drain-pipes.*" Patent dated July 3, 1874.

With the traps now used for preventing the escape of gases from sewers and drains, the water which seals the trap to some extent absorbs gases from the interior of the trap which is open to the sewer or drain, and again gives off these gases from its surface in the outer part of the trap, so that the trap does not entirely prevent the escape of gas from the sewer. To prevent this a trap is employed into which is introduced a small quantity of hydrocarbon or other non-saponifiable oil which is lighter than water, and the trap is constructed in such a manner that when water or liquid is passed through the trap into the sewer or drain the hydrocarbon oil shall not be carried away along with it. To effect this the limbs of the syphon trap are made much longer than heretofore usual, and just below the end of the inlet into the trap is fixed a disc against which any liquid entering the trap strikes, and is deflected in all directions against its sides, so that the liquid, instead of being carried with a rush through the trap, passes through it quietly, and does not carry away along with it any of the oil, but the oil floating upon the surface of the water remains in the trap. A small quantity of hydrocarbon oil is thus at all times within the trap, and as from its nature it will not absorb gases, it acts as a perfect seal.

2338.—WELLS, J., Wednesbury, "*Certain improvements in main cocks for gas and water purposes, but which said improvements are also applicable for main cocks for the controlling of other fluids.*" Patent dated July 4, 1874.

This invention consists in contracting the body or barrel of the cock below the plug, the contracted part having a concentric hole for a reduced portion of the plug to pass through, on which part a square or other angular shape is formed, which passes through a metal washer, by preference of brass or copper, whilst the reduced part of the plug extending beyond the square or angular form is tapped for receiving the holding-in nut. It is desirable also that the ground portion of the plug should not extend to the bottom of the barrel or ground recess in which it works, as it allows room for regrinding without the base of the plug and bottom of the recess coming in contact. This simple contrivance is calculated to greatly reduce the friction on the action of the plug, simplifying the construction, and diminishing the cause of leakage.

2371.—WALKER, W., Newton Moor, "*Improvements in direct-acting steam pumping-engines.*" Patent dated July 7, 1874.

These improvements consist in employing a double-ended piston having a cylindrical part working in a partition piece. The steam is admitted into the annular space around the cylindrical piece, and is then expanded into the larger steam space. As the piston works to and fro, communications are effected, by means of passages in the piston cylinder and in the main cylinder, for the flow of steam from the end spaces in the valve-box into the exhaust passage, to effect the movement of the valves.

2380.—BEAN, E. E., Boston, U.S.A., "*A pneumatic electric gas-lighting apparatus.*" Patent dated July 7, 1874.

This invention relates to an apparatus for lighting gas at the lamp-burners, and it is operated by means of two elements—viz., compressed and rarefied air acting upon flexible diaphragms for the purpose of opening and closing the gas-cocks, and electricity for the purpose of igniting the gas at the burner.

The manner of operation is as follows:—First, all the gas-cocks on the lamps that are to be lighted are opened by admitting compressed air from a suitable reservoir through underground connecting-pipes to the flexible diaphragms that are coupled to the levers on the gas-cocks. When all the gas-cocks are opened, the gas is lighted at the burners by means of an electric spark, conveyed through wires from a galvanic battery to a point close to the openings in the burners.

When the lights are to be extinguished the cocks are shut by means of rarefied air or vacuum acting on the rear of the flexible diaphragms, by this means extinguishing a great number of lights in a very short time.

2397.—WILSON, H., Stockton-on-Tees, and STEEL, J., Glasgow, "*Improvements in apparatus for cooling and heating liquids and gases.*" Patent dated July 8, 1874.

This invention consists in certain improvements in the arrangement and construction of refrigerators and other apparatus for the cooling or heating of liquids, gases, and such like, especially applicable to the form of refrigerator known as Steel and Wilson's patent, No. 975, April 13, A.D. 1871.

The first part of this invention consists in the mode of fastening the tubes which contain the liquid to be operated by or upon to the main body of the apparatus, so that they may be easily removed and replaced, each set of tubes being secured to a junction-box, the opposite end being secured to a plate, which plate is secured to a watercourse by bolts, and made water or air tight by elastic washers.

The second part of this invention consists in the application of a current of air which is discharged into or upon the liquid passing through the apparatus through a series of pipes placed on diaphragms, these pipes being connected to to the main-pipe running along the side of the apparatus, which is supplied with heated or cold air by a fan or other means.

The third part of the invention consists of the application of a series of arms or shafts having tines or fingers projecting down between each set of tubes, having for their object the stirring or breaking up of the currents of liquid passing through the apparatus, the motion being imparted to them by an eccentric actuating the shaft or arm to which the tines or fingers are attached, the motive power being obtained by preference from a small turbine or water-wheel driven by the water that passes through the refrigerator or in any other suitable manner. As an alternation the apparatus is sometimes hung on swivels, and an undulating motion applied to it.

2404.—COOPER, H. E., Bethnal Green Road, London, "*Improvements in the means of and in apparatus for carburetting air or gas for illuminating or heating purposes.*" Patent dated July 8, 1874.

This invention consists—(1) in passing air or gas amongst wicks composed of cotton or other fibrous material impregnated with hydrocarbon spirit; (2) arranging the carburetter with a series of fibrous wicks, the lower ends of which are suspended in a tray or trays of hydrocarbon liquid, the level being maintained uniform by overflow-pipes; (3) employing bellows to force the air or gas through the carburetter, the top and bottom or outer boards of which are fixed, and having a moving middle board, by which means a double-action bellows is obtained in a simple manner; (4) in employing an elastic bag connected to the air or gas passage, to act as a regulator or controller to prevent flickering of the flames at the burners.

2408.—HALLSWORTH, S., Armley, and BAILES, R., Leeds, "*Improved means or method of treating and clarifying impure or waste water from fulling-mills, scouring-mills or scouring processes, dye-houses, sewage or other impure waters.*" Provisional protection only obtained. Dated July 9, 1874.

These improved means consist in the employment of bisulphate of iron, or sulpheric acid and iron, or sulpheric acid and mother liquor from the crystallization of copperas, for effecting the sediment of the impurities after agitation.

2409.—DIXON, F., Cliftonville, Brighton, "*An improved method of and apparatus for disinfecting and deodorizing the injurious gases arising from sewers and drains.*" Patent dated July 9, 1874.

The object of this invention is to effectually disinfect and deodorize the gases given off at the ventilating shafts or other openings of sewers and drains, by causing such gases to pass through flannel, cloth, sponge, or other porous materials saturated with a disinfectant or deodorizer, the flannel or other material being fitted in a suitable apparatus.

2428.—MACKENZIE, T., Wednesbury, "*Improvements in steam pumping and blowing machinery.*" Patent dated July 10, 1874.

According to this invention the steam cylinder, blowing cylinder, and pump cylinder, are in the same line, one piston-rod serving for the three. The steam cylinder is placed between the blowing cylinder and pump cylinder, the valve gearing of the cylinder being worked by plugs or rods, which are struck by the piston of the steam cylinder. A condenser is combined with the pump cylinder, and is

put in connexion with the exhaust-pipe of the steam cylinder, and which, by effecting the condensation of the waste steam, materially increases the power of the steam cylinder. The condenser may be applied to steam-pump cylinders of various kinds, and the combination of steam-pump and condenser may be used apart from the blowing apparatus.

2431.—WHITTON, C., Leslie, N. B., "*Improvements in stop-valves for steam and other pipes.*" Patent dated July 11, 1874.

According to these improvements the main closing detail of the valve is a disc with a conical edge fitting in a corresponding conical seat, and fixed on a spindle, which is situated in the axis of the piping, or nearly so. The valve is placed so as to open against the pressure, and it is opened by means of a handing lespind placed at right angles to the axis of the valve and piping.

2434.—WARREN, S. H., Crewe, and WATES, P. J., Greenwich, "*Improvements in machinery and apparatus for charging and drawing retorts.*" Patent dated July 11, 1874.

The objects of this invention are the charging and discharging of gas-retorts and similar apparatus by machinery in a better manner and at less cost than heretofore. The machine for this purpose consists of a stout quadrilateral frame mounted upon wheels, and capable of travelling as a whole to and fro in the retort-house on a line of rails parallel to the front of the retorts. Within this frame, regulated by suitable guides, a table or framework is placed, carrying the scoop and rake, which can be raised or lowered at pleasure by means of screws, racks, and pinions, or other equivalent mechanical means, a screw being preferred, so that the scoop and rake may be brought to the level of the retorts to be operated upon. Extending the whole length of this frame are two horizontal screws which are caused to rotate at a suitable speed, and by so doing to push forward nuts to which the charging and discharging tools are fixed, thus putting them into the retort. By reversing the direction of the rotation of the screws the rakes and scoops are withdrawn. The scoop is fixed to the one nut and the rake to the other, and they may be propelled or withdrawn either together or separately.

All the motions of the various parts of the machine are obtained by means of an endless rope running from end to end of the retort-house. This rope, being brought to bear upon a grooved wheel at the top of the machine, causes by its friction the shaft attached to the wheel to rotate; communication from this shaft to the various parts being obtained by means of an arrangement of frictional cones and suitable bevel wheels. A hopper is also attached to the machine for the purpose of holding coal and delivering it in given quantities into the scoop.

Automatic means are arranged that the motion of the scoop or rake may be reversed. Instead of the elevating arrangement, one or more scoops and rakes may be used, or the charging and drawing machines may be made separately. Any number of machines may be driven by the same rope upon either or both sides of the retort-house.

2439.—SCHMERSAHL, A. E., Manchester. "*Improvements in treating sewage water and other foul liquids for the purpose of purification, and in the manufacture of manure.*" Patent dated July 11, 1874.

The features of novelty in this invention consist in treating sewage water and other foul liquids with a mixture of about two pints of diluted sulphuric acid and one part of hydrochloric acid, or with phosphomuriate of lime, commonly called bone liquor, or with chloride of manganese, and then adding sufficient milk lime to the sewage to neutralize the acid. Besides purifying the liquid, a precipitate is thus formed which may be used alone as manure, or be added to other manurial agents in the manufacture of manure.

2446.—LYTTLE, W. A., Hammersmith, "*An improved process for treating sewage and for utilizing certain products derived therefrom, which improvements are partly applicable to other purposes.*" Provisional protection only obtained. Dated July 13, 1874.

The features of novelty in this improved process are as follows:—1. The utilization of the sedimentary matter or "sludge" of sewage in the smelting of iron, the carbonaceous matter and the silicates of the sludge being made to serve in various ways as auxiliary to the fuel and fluxing materials now employed. 2. The consolidation of the "duff" or colliery dust of coal or the dust of peat charcoal by incorporating sludge with dust, and then making the mixture into lumps for smelting fuel. 3. The consolidation in the last-mentioned way of a mixture of crushed iron ore, lime, sand, powdered fuel, and sludge, so as to make a conglomerate containing in itself all the materials of a smelting-furnace charge. 4. The filtration of the effluent water of sewage through a "vortex filter," consisting of charcoal kept in slow movement by a pug-mill arrangement. 5. The recovery of ammoniacal liquor from the exhausted charcoal of this filter by coking. 6. the use of the charcoal in the first instance for filtering the drinking water supplied to a town before such charcoal is used for sewage purposes.

2450.—SCOTT, H. Y. D., Ealing, "*Improvements in the recovery of carbonate of ammonia from sewage.*" Patent dated July 13, 1874.

These improvements consist in employing calcined magnesite or magnesia produced in any way, and adding such a quantity only of phosphoric acid or soluble phosphate, or phosphate dissolved in mineral acids, as will leave the magnesia in considerable excess.

2461.—SPENCE, W., Chancery Lane, London, "*Improvements in the treatment of urine and liquid sewage in order to fix the azote and phosphate substances contained therein, and convert them into solid matter, and in apparatus for the same.*" A communication. Provisional protection only obtained. Dated July 14, 1874.

This invention consists in passing the liquid sewage and fœcal matter without filtration into a series of receptacles placed at successively lower levels, in which the material, after being mixed with acid and well stirred, is gradually dried. The product contains in a fixed but soluble state all the azote and phosphorus in the original matter, retaining the richest ingredients for manure.

2466.—JONES, H. L., Holborn, London, "*Improvements in apparatus for disinfecting water-closets, urinals, and similar purposes.*" Patent dated July 15, 1874.

This apparatus consists of a cylindrical or other shaped recipient containing a fluid disinfectant of some sort, screwed down to the flooring by passing a metal collar over it, which rests on a rim of the recipient, which is of earthenware or other substance, and is arranged beneath the closet seat.

The action of the apparatus is as follows:—On drawing up the closet handle, a rod in connexion with it also draws up a piston which moves up and down a glass-lined cylinder arranged inside the recipient, the effect of this upward movement is to admit the fluid disinfectant into the internal cylinder, and by the descent of the closet handle a like motion is imparted to the piston, which is of gutta percha or other substance, and the pressure exercised by the piston in its descent forces the fluid from the cylinder up a tube or pipe in direct communication with the closet pan, so that the fluid mingles with the trapping water remaining in the pan after the flushing of the closet.

The same principle is applicable to closets where the seat is made to depress for flushing the closet; and in the case of urinals a board is made to actuate the piston by depression. The apparatus is valveless.

2468.—WARBURTON, S., Pendleton, "*An improved apparatus for the purpose of singeing off the loose fibres of yarns by means of atmospheric gas.*" Provisional protection only obtained. Dated July 15, 1874.

An apparatus constructed according to this invention consists of a hollow tube in the form of a T. The lower or vertical piece is left open at the bottom for the admission of gas, and perforated for the admission of atmospheric air. The transverse or cross piece is perforated on the top near each end. These perforations are covered with circlets or sleeves of fine brass or other wire gauze, which form the two burners, one at each end of the gaselier. The ends of the transverse or cross piece are closed by means of moveable plugs, which can be pushed in or drawn out so as to regulate the size (or, if need be, increase the number) of the lights according to the quality of the yarn to be singed. Each of the plugs is fitted with a rest of V or other suitable shape, to guide the yarn over the burners.

The vertical hollow tube supporting the transverse tube is also provided with a sleeve or circlet of suitable material by which the admission of air can be regulated. The vertical tube is placed over an ordinary gas-pipe, which extends slightly above the perforations, and which is provided with a tap for regulating the supply of gas.

An apparatus constructed according to this invention may be fixed on the table of a winding frame opposite each bobbin, so that as the yarn is wound on to the bobbin it is singed during its passage over the burner, and the same winding frame can be used for winding or singing as required.

APPLICATIONS FOR LETTERS PATENT.

761.—LAKE, W. R., Southampton Buildings, London, "Improvements in apparatus for regulating the flow of gas, steam, or air." A communication. March 2, 1875.

770.—CLARK, A. M., Chancery Lane, London, "Improvements in gas-meters." A communication. March 2, 1875.

775.—GOOCH, Sir F. S., Bart., Grosvenor Square, London, "Improvements in regulating the flow of liquids in apparatus employed for reducing such liquids from a higher to a lower temperature." March 3, 1875.

786.—SUGG, W. T., Westminster, London, "Improvements in lamp-burners." March 3, 1875.

791.—LAWRENCE, J. E., and PORTER, E. V., Westminster, London, "Improvements in centrifugal pumps." March 3, 1875.

793.—JUSTICE, P. S., Southampton Buildings, London, "Improvements in valves." A communication. March 3, 1875.

797.—ELBOROUGH, C. M., King's Arms Yard, London, "An improved meter for liquids." A communication. March 4, 1875.

806.—WIER, M. A., Abchurch Lane, London, "Improvements in the means of igniting gas and in apparatus employed therein." March 4, 1875.

812.—CLARK, A. M., Chancery Lane, London, "Improvements in pumps." A communication. (Complete Specification.) March 4, 1875.

818.—CHIVERTON, E., Southsea, "Improved means of and apparatus for lighting gas lamps and burners." March 5, 1875.

820.—WISE, W. L., Adelphi, London, "An improved continuous horizontal apparatus for washing or absorbing gas or vapours, or for distilling liquids." A communication. March 5, 1875.

826.—JOHNSON, J. H., Lincoln's Inn Fields, London, "Improvements in traps or apparatus for separating liquids from vapours or gaseous fluids." A communication. March 5, 1875.

833.—FARNSWORTH, S., Mansfield, Notts, "Improvements in valve apparatus for controlling the passage of water or other fluids." March 6, 1875.

838.—HUMPHRIES, J. R., Middlesbrough-on-Tees, "Improved apparatus for preparing the joints of leaden and other soft metal pipes." March 6, 1875.

839.—COOKE, J., Durham, "Improvements in the construction of rotary engines and pumps." March 6, 1875.

862.—MANN, W., Blackfriars Road, and OWENS, S., Whitefriars Street, London, "Improvements in valves." March 9, 1875.

892.—TAYLOR, F. B., Bayswater, London, "An improved steam-engine, also applicable for use as an air, water, or other fluid motor." March 10, 1875.

902.—CAREY, R., Southwark, and PORTER, R., Fenchurch Street, London, "Improvements in valves for regulating the flow or discharge of gas, water, and other fluids." March 11, 1875.

GRANTS OF PROVISIONAL PROTECTION.

590.—PEACOCK, J. C., Bloomsbury, and RUDKIN, T., Smithfield, London, "Improvements in apparatus for cooking and boiling by means of gas." Feb. 18, 1875.

594.—ATKINS, J., and TORR, C. W., Birmingham, "Improvements in the construction and ornamentation of gaseliers, chandeliers, candelabra, and other lamps, and in gas-brackets." Feb. 18, 1875.

602.—WILLIAMSON, W. B., Bradford, York, "A new or improved system and means of preventing the pollution of rivers, and extracting and carrying away the noxious vapours from sewers so as to prevent deleterious effects therefrom." Feb. 18, 1875.

622.—SPEIR, R., Greenock, and MATHER, J., Gateshead-on-Tyne, "Improvements in the manufacture or production of gas for illuminating or heating purposes, and for actuating gas-engines." Feb. 20, 1875.

660.—BATES, G., Lewes, "Improvements in apparatus for attaching main-cocks, valves, plugs, or other connexions to service-pipes for water when under pressure." Feb. 23, 1875.

668.—NEUHAUS, M., Strand, London, "Improved means and appliances for the production of lighting and heating gas from air and spirituous vapour combined." Feb. 23, 1875.

678.—WIRTH, F., Frankfort-on-the-Maine, Germany, "Improvements in stop-valves." A communication. Feb. 24, 1875.

681.—JOHNSON, J. H., Lincoln's Inn Fields, London, "Improvements in the treatment of gases, liquids, and pulverulent substances, and in the machinery or apparatus employed therein." A communication. Feb. 24, 1875.

694.—BOULTON, M. P. W., Oxford, "Improvements in apparatus for condensing steam or vapour." Feb. 25, 1875.

696.—QUICK, J., jun., and RESTLER, J. W., Westminster, London, "Improvements in meters for measuring liquids." Feb. 25, 1875.

721.—KELEN, L. V., Brussels, "An improved gas-stove." Feb. 26, 1875.

724.—REYNOLDS, O., Manchester, "Improvements in apparatus for obtaining motive power from fluids, and also for raising or forcing fluids." Feb. 27, 1875.

734.—CHAMBERS, A., Marylebone Road, London, "Improved apparatus for facilitating the ignition of gas in the lamps of railway carriages." March 1, 1875.

737.—KEIRBY, J. E., Swinton, Lancaster, "Improvements in elastic and other packings for pistons and piston-rods of steam-engines, pumps, rams, and other similar purposes." March 1, 1875.

744.—DICKSON, J. F., Leicester, "Improvements in air and gas engines or motors." March 1, 1875.

NOTICES TO PROCEED.

227.—BLAKEBOROUGH, R., Brighouse, York, and BECK, J., Great New Street, London, "Improvements in hydrants and fire-cocks." Jan. 21, 1875.

400.—JOHNSON, R., Bradford, York, "Improvements in machinery for obtaining motive power for raising, forcing, and exhausting fluids and liquids, and for measuring liquids." Feb. 3, 1875.

590.—PEACOCK, J. C., Bloomsbury, and RUDKIN, T., Smithfield, London, "Improvements in apparatus for cooking and boiling by means of gas." Feb. 18, 1875.

602.—WILLIAMSON, W. B., Bradford, York, "A new or improved system and means of preventing the pollution of rivers, and extracting and carrying away the noxious vapours from sewers so as to prevent deleterious effects therefrom." Feb. 18, 1875.

681.—JOHNSON, J. H., Lincoln's Inn Fields, London, "Improvements in the treatment of gases, liquids, and pulverulent substances, and in the machinery or apparatus employed therein." A communication. Feb. 24, 1875.

INVENTION PROTECTED FOR SIX MONTHS ON THE DEPOSIT OF COMPLETE SPECIFICATION.

812.—CLARK, A. M., Chancery Lane, London, "Improvements in pumps." A communication. March 4, 1875.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

3082.—COOPER, W., Southampton, "An improved rotary steam-engine and pump." Sept. 8, 1874.

3087.—WILKES, J. P., Great Tower Street, and AUNIER, A., Notting Hill, London, "Improvements in the mode of and apparatus for the extraction and treatment of sulphur." Sept. 9, 1874.

3095.—ROWBOTTOM, J., Halifax, "Improvements in retorts and in means or apparatus for charging and discharging the same." Sept. 9, 1874.

3101.—ATKINS, T., St. Alban's, Herts, "Improvements in stoppers, valves, and apparatus for filling and discharging bottles, vessels, store chambers, mains, or other holders used for containing fluids, liquids, gases, or vapours." Sept. 10, 1874.

3152.—POCOCK, A. W., Westminster, London, "Improvements in compensating wet gas-meters." Sept. 15, 1874.

3199.—KIDD, J. H., Wrexham, "Improvements in the mode of and in arrangements and apparatus for manufacturing manure from sewage, night soil, and like matters, and in the preparation and application of certain materials for deodorizing sewage, night soil, and like matters." Sept. 19, 1874.

3699.—HAMBLETON, F. H., Baltimore, U.S.A., "Improvements in apparatus to admit of the continuous running of a pump or other apparatus supplying fluid through pipes when the flow through the pipes is for a time wholly or in part arrested, without injury to the pipes and without waste of fluid." A communication. Oct. 26, 1874.

3799.—BOND, F. T., Gloucester, "Improvements in deodorizing and disinfecting materials, and in apparatus for applying the same." Nov. 4, 1874.

4413.—POWELL, J. W., Bermondsey, London, "Improvements in apparatus for regulating and controlling the supply and flow of water and other liquids." Dec. 23, 1874.

4436.—SAXBY, F. E, Liverpool, "Improvements in condensers for steam pumping engines." Dec. 24, 1874.

9.—FISH, W. S., Connecticut, U.S.A., "A new or improved compound material applicable for packing stuffing-boxes of engines, pumps, and other mechanism for packing joints of pipes, boilers, tanks, cylinders, and valve-chests, and others analogous thereto, and which is also applicable for covering floors, roofs, and other surfaces." Jan. 1, 1875.

96.—BOULTON, M. P. W., Oxford, "Improvements in engines worked by hot gases, or by hot gases and steam, parts of which improvements are applicable for generating steam." Jan. 11, 1875.

150.—RYDILL, G., Chancery Lane, London, "Improvements in machinery and apparatus in the construction and working of vessels, tanks, reservoirs, and areas, and materials used for the purification of sewage and other polluted waters." Jan. 14, 1875.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

375.—BONNEVILLE, H. A., "Certain improvements in apparatus for lighting gas by electric currents or otherwise." Feb. 5, 1872.

379.—FRANCE, F. G., and WHITTHREAD, W., "Improvements in the utilization of sewage." Feb. 6, 1872.

416.—CRESSWELL, A., "Improvements in apparatus for straining or filtering liquids." Feb. 9, 1872.

432.—LAKE, W. R., "Improvements in gas-engines." Feb. 10, 1872.

472.—JOHNSON, T., "Improvements in valves for sewers or drains for preventing or arresting the passage of noxious or offensive gases." Feb. 14, 1872.

484.—HILLÉ, F., "Improvements in the treatment and utilization of sewage, and the manufacture of manure therefrom." Feb. 15, 1872.

519.—HESHUYSEN, W. F., "An automatic water or other fluid regulator." Feb. 17, 1872.

523.—TYLOR, A., and FLEURY, F. G., "Improvements in apparatus for regulating, controlling, and arresting the flow of liquids and fluids, and preventing waste." Feb. 17, 1872.

588.—PORTER, R., and LANE, T., "Improvements in apparatus used in the manufacture of gas." Feb. 23, 1872.

607.—BLUNDELL, T., BLUNDELL, G. T., and BLUNDELL. J. W., "Improvements in the construction of water-closets, and in the mode and means of regulating the supply of water to their pans." Feb. 26, 1872.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £100 BEFORE THE EXPIRATION OF THE SEVENTH YEAR.

643.—LAIDLAW, R., and THOMSON, J., "Improvements in apparatus for exhausting gas, for blowing air, for pumping or forcing liquids, and for measuring liquids." Feb. 26, 1868.

674.—STIDDER, J. G., "Improvements in water-closets, lavatories, and urinals, and in regulating supplies for same by water-valves." Feb. 28, 1868.

770.—CLARK, A. M., "Improvements in steam-pumps." March 5, 1868.

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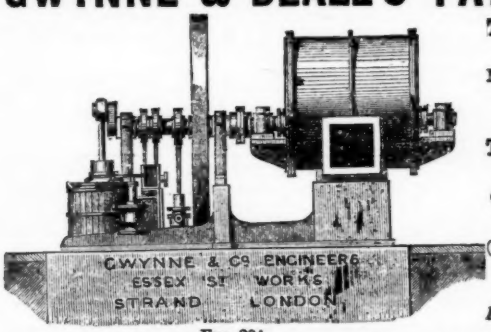

FIG. 224.

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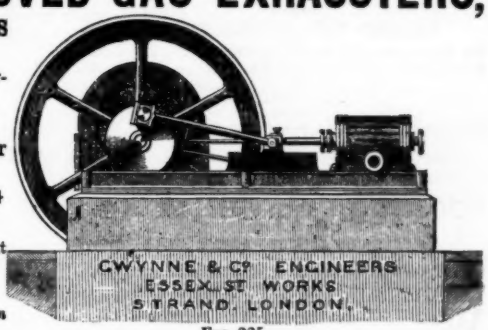

FIG. 225.

Fig. 224 represents one of those erected at the Imperial Gas-Works, Bromley, capable of passing 210,000 cubic feet of gas per hour. Several others of the same size are now on order for the same Company. These Patent Machines combine the highest quality of workmanship and materials, the largest bearings and wearing surfaces, with the **most perfect system of action yet discovered.** Fig. 225 represents one of a series of four at the Nottingham Gas-Works, each passing 52,500 cubic feet per hour. GWYNNE AND CO. *do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality, and the most approved design and arrangement.* Their prices have been estimated with a due regard to the **excellence of the article produced,** and when this is taken into consideration, they have no fear for the result. The orders executed this season for Exhausters and alterations to their patented system amount to over 4,000,000 cubic feet of gas passed per hour, and to over 300 horse power for Engines to drive them. In every instance their work is giving the greatest satisfaction. Numerous testimonials and references can be given.

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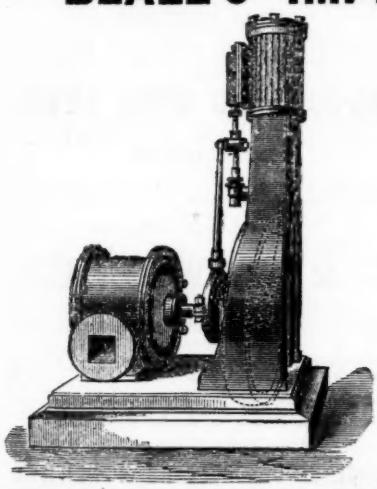

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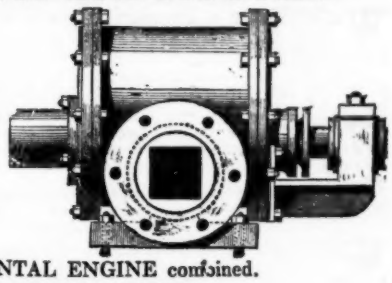

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Gas-Works, Dudley, March 10, 1875.

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Tenders, endorsed "Tender for Purifiers," to be forwarded to me not later than the 3rd day of April next.
The lowest or any tender not necessarily accepted.
R. BRIERLEY.
Town-Hall, Newton-le-Willows, Lancashire,
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By order,
HUGH DUNN, Town-Clerk.
Darlington, March 10, 1875.

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TO GASHOLDER MAKERS.

THE Corporation invite Tenders for a Telescopic GASHOLDER, 102 ft. in diameter.
The drawings and specifications may be seen at the Gas Offices, Bolton, on application to the Engineer, Mr. Harrison Veevers.
Tenders, addressed to the undersigned, endorsed "Gasholder," to be delivered before Monday, the 29th inst.
The Corporation do not bind themselves to accept the lowest or any tender.
R. G. HINNELL, Town-Clerk.
Town-Hall, Bolton, March 8, 1875.

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THE Directors of this Company invite TENDERS for the supply of 1350 tons of GAS COAL (unscreened), to be delivered free at the Windsor Station of the Great Western Railway, such Coals to be either of the following descriptions—viz., New Pelton, Wearmouth, Holmside, Burnhope, or Pelaw Main.
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GEO. CARTLAND, Secretary.
The Gas-Works, Windsor.

SOUTH METROPOLITAN GASLIGHT AND COKE COMPANY.

NOTICE is hereby given that the ORDINARY HALF-YEARLY GENERAL MEETING of the PROPRIETORS of this Company will be held at the London Tavern, in the City of London, on MONDAY, the 5th day of April next, at Two o'clock in the afternoon precisely, to receive the Directors Report and the Accounts of the Company for the half year ended the 31st of December last, to declare a Dividend, and to elect a Director in the place of W. Baker, Esq., and an Auditor in the place of Archibald F. Paull, Esq., who retire from office at this meeting, but, being eligible, offer themselves for re-election.
Any Proprietor holding forty shares intending to become a candidate for either of these offices, must give notice in writing at the Office of the Company, at least fourteen days previously to the day of election.
The Transfer Books of the Company will be closed from the 22nd of March until after the meeting.
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JAMES ESCOTT, Secretary.

TENDERS FOR TAR.

THE Directors of the Imperial Gaslight and Coke Company, London, are open to receive TENDERS from parties willing to purchase the TAR the Company may desire to dispose of at their several works—viz., at York Road, King's Cross, N.; Gloucester Street, Great Cambridge Street, Hackney, E.; Sand's End Lane, Fulham, S.W.; and Bromley-by-Bow, E.
Forms of tender may be obtained from the undersigned, to whom the tenders must be sent on or before Wednesday, the 24th inst.
The Directors give notice that they do not hold themselves bound to accept the highest or any tender.
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Office of the Company, 33, John Street, Bedford Row,
London, March 10, 1875.

TENDERS FOR AMMONIACAL LIQUOR.

THE Directors of the Imperial Gaslight and Coke Company, London, are open to receive TENDERS from parties willing to purchase the AMMONIACAL LIQUOR the Company may desire to dispose of at their several works from the 16th of April, 1875—viz., at York Road, King's Cross, N.; Gloucester Street, Great Cambridge Street, Hackney Road, E.; Sand's End Lane, Fulham, S.W.; and Bromley-by-Bow, E.
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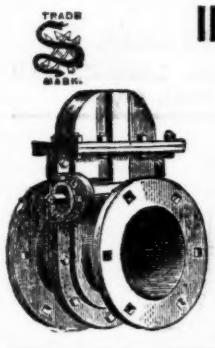

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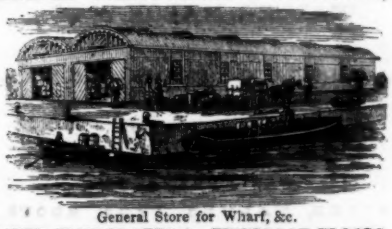

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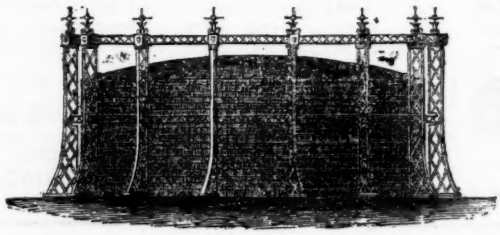

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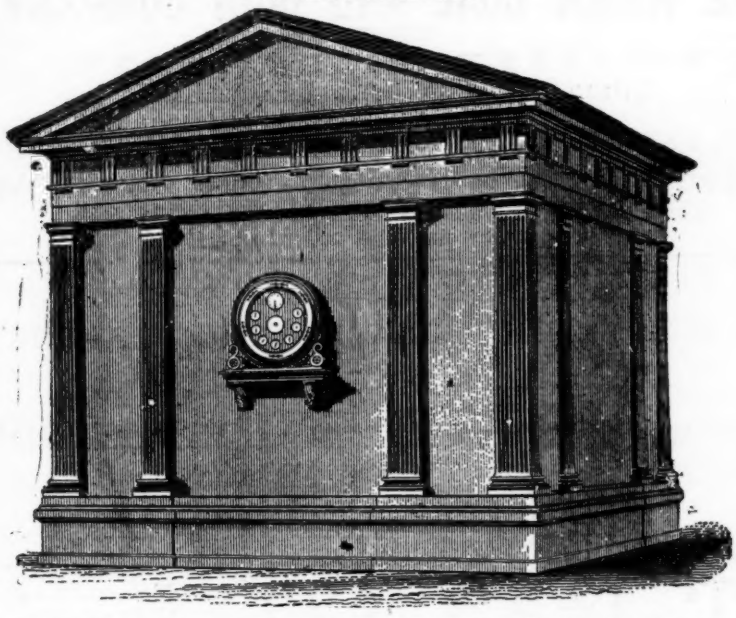

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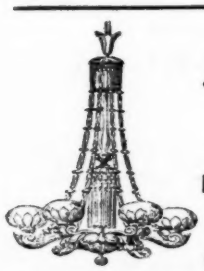

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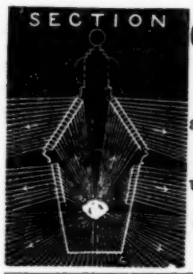

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Of superior quality, delivered at any station in England and Wales.

Purified gas per ton of coal in cubic feet (average)	10,775
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	Cubic Feet of Gas per Ton of Coal.	Illuminating Power in Candles.	Coke per Ton of Coal used.	Ash in Coke, per Cent.	Sulphur in Coal, per Cent.
Silkstone Nuts . . .	10·800	15·85	12·66 cwt.....	6 0	0·69

NOTE.—The illuminating power of the gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

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Beg leave to call the attention of Gas Companies to the superior quality of their
CANNEL FOR GAS-MAKING PURPOSES.
This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 33-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.
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This Company request attention to the very superior quality of their Cannel Coals.

1. The following are the practical results given by Dr. Wallace, of Glasgow, of analyses of their Lochore and Capledrae Cannels:—

	Sample worked at Capledrae.		Sample worked at Lochore.
Gas per ton of coal, at 60° Fahr. and 30 inches barometric pressure	13,095 cubic feet.	..	11,760 cubic feet.
Illuminating power, in standard sperm candles, by union jet consuming 5 cubic feet per hour, at ·5-inch pressure	32·91	..	34·83
Value of 1 cubic foot of gas in grains of sperm	780	..	836
Equivalent of a ton of coal in pounds of sperm candles	1,459	..	1,404
Durability of 1 cubic foot by 5-inch flame	69 minutes.	..	71 minutes.
Gravity of the gas (air = 1000)	596	..	594

Remarks.—This (the sample from Capledrae) is a Cannel Coal of first-class quality, giving 13,000 feet of 33-candle gas. It contains only a minute proportion of sulphur, and the ash is almost quite white. The coke is of rather inferior quality.

Remarks on Sample from Lochore.—This is a Cannel Coal of first-class quality, giving a large yield of very rich gas and a coke of medium quality.

2. The following are the practical results of analyses by Dr. Wallace of the Company's Waverley Cannels:—

	Capledrae Waverley.		Lochore Waverley.
Gas per ton of coal, at 60° Fahr. and 30 inches barometer	9,120 cubic feet.	..	11,145 cubic feet.
Illuminating power, in standard candles, by union jet consuming 5 cubic feet per hour, at ·5-inch pressure	36·62	..	33·09
Value of 1 cubic foot of gas in grains of sperm	878	..	794
Equivalent of a ton of coal in pounds of sperm candles	1,145	..	1,264
Durability of 1 cubic foot of gas by 5-inch flame	80 minutes.	..	67 minutes.
Gravity of the gas (air = 1000)	677	..	597

Remarks on the Sample of Capledrae Waverley.—This Coal gives fully 9000 feet of gas of 36½ candles, and is admirably adapted for bringing up the quality of gas made from common coal or inferior qualities of cannel. The tests were made at a rather high temperature, this being one of the coals that stand a very high heat without serious diminution of the illuminating power of the gas The coke contains 60 per cent. of ash, and is therefore almost valueless, but the proportion of sulphur is very moderate.

Remarks on the Lochore Waverley.—This is a first-class Cannel Coal, giving 11,000 cubic feet of 33-candle gas. The quantity of sulphur is very minute, and the ash is nearly white. The coke is of inferior quality, but not wholly valueless.

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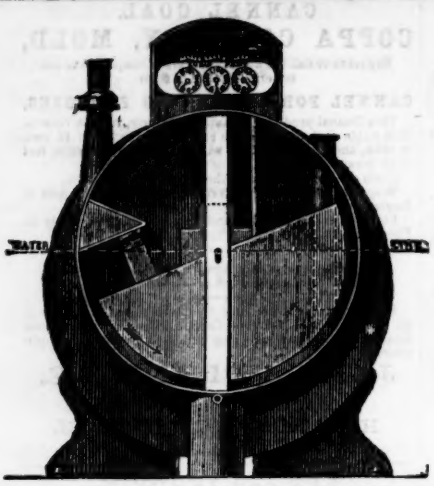

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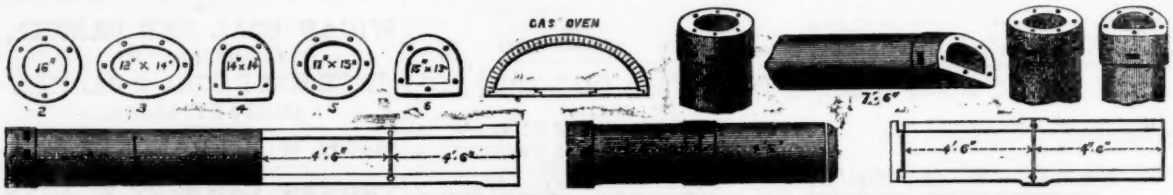

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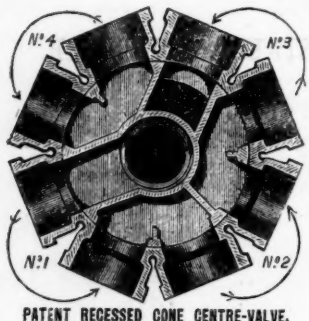

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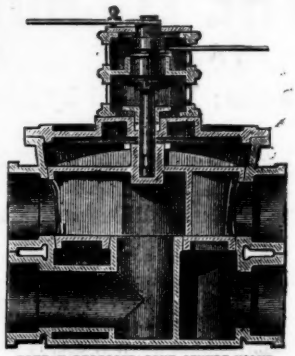

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